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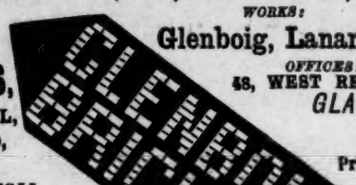

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EDITORIAL NOTES.

The Calorific Power Bill and the Chemical Manufacturers.

THE Gas (Standard of Calorific Power) Bill had second reading in the House of Commons last Tuesday, and was considered in Committee, read the third time, and passed on Thursday night, and without amendment, though effort was made to obtain certain unnecessary modifications in (so it was represented) the interests of the gas consumers, but obviously in the interests of chemical manufacturers. The two discussions showed a House almost completely in sympathy with the measure. Even those who sought amendment admitted the propriety of deposing an ancient use of gas as the foundation for a standard of quality, and of setting up the maximum modern use of gas as furnishing the basis for a correct standard. To the Bill there should be gratitude on the part of the industry; for it has revealed the Legislature now wisely recognizing that a luminous flame as a standard of quality is dead, and that the quicker it is buried the better for all concerned, and especially for the nation at a time when—as Mr. E. G. Pretyman, the Parliamentary Secretary of the Board of Trade, said—benzol and toluol are "badly required." The requirement will not cease with the war; several industries in the peace times ahead will demand from the gas industry the substances which it is now producing for the purposes of the war. And there is one thing that is quite clear. It is that it will be waste of time for gas undertakings not serving the country by enlarging, within the limits of their opportunities, the supply of benzol and toluol to ask during the war for a change of standard of quality under the Bill; for Mr. Pretyman unblushingly acknowledged that the primary object of the introduction of the measure at the present time is to secure more of the substances needed for explosives, rather than to facilitate just now the transfer of gas undertakings from an invalid to a valid standard. The transfer from the one standard to the other is subservient to the filling of a national need; but, under the circumstances of gas supply, it is fitting that the change should be a permanent one.

During the discussion both on second reading and in the Committee stage, chemical interests were too prominent for the veiling of motives. It was plain that, while it was recognized that it was impossible to object to the transfer from the one standard to the other without inviting ridicule, the post-war liberty that the change will confer on gas undertakings in supplementing the production of benzol, &c., is not at all palatable to the chemical manufacturers; and therefore they wanted some curbing conditions set on that liberty. To whose advantage? The spokesmen—Mr. J. King, Sir William Pearce, and Mr. Brunner—said, in effect: "To the advantage of gas consumers." But that anyone interested in the chemical industry should be so solicitous for gas consumers is passing strange; and we venture to think that, if "gas consumers" be translated into "chemical "manufacturers," we shall be nearer the truth of the matter. It is not known by us whether Mr. King is directly or indirectly interested in the chemical industry. If he is not, he had been particularly well primed as to the evil consequences that would befall a country anxious for further supplies of the necessaries produced by the washing of gas, and abundance in the provision of which is in the economic interests of the country. But Mr. King fears that the calorific standard will encourage gas undertakings to go into the chemical trade, and that the consequence of this will be over-production. From the standpoints of national economy and the progress of the gas industry, the argument is about the most flaccid that Mr. King could have employed. There is no desire to go into the chemical trade beyond any point that is not economically beneficial for undertakings and consumers alike. It is a root principle in industrial economy that the country should realize the utmost from its own raw materials, so long as there is profit in the realization; and to that principle the gas industry adheres.

The chemical manufacturers, or their spokesmen, made a grievous mess of their arguments. The gas industry has grown to large proportions, and represents much in the way of capital and activity in the operations of the country; but the very administrators and technical workers who have accomplished so much for the industry and its customers, and have with alacrity done so well in relieving the perilous situation in which the country found itself early in the war (so helping in a material manner to make possible the great push just now taking place on the western front), may, the chemical manufacturers insinuate, be tempted to speculate in chemical work and do other stupid things, to the detriment of their consumers. The administrators have proved themselves men of sense, and their technical advisers have equally shown that they are not devoid of the same useful attribute. Placed alongside the aggregate of success of the gas industry, the submissions of the chemical manufacturers are ludicrous. Apart from the sliding-scale in the case of companies, and the statutory financial control exercised over maximum-price concerns, the managements of gas undertakings are not, with the stern competition of electricity for lighting purposes, coal for heating, and coal, electricity, and oil for power, going to do anything to prejudice their position, whatever the chemical manufacturers may say in order to secure the imposition of some additional hindering limitations, which would be of no advantage to the gas consumers, but would be to the chemical manufacturers.

There was talk (notwithstanding that gas consumers have not experienced any damage during the past twelve months) of a special reduction in the price of gas in consideration of the branching-out by the industry into the new recovery operations. Who would be prepared to fix the amount of such reduction, or to state the basis on which it should be made in an industry with, in the case of companies, controlled dividends, reserves, and balances forward; and with surpluses over and above the parliamentary stipulation already devoted to reducing the price of gas alike in the interests of consumers and shareholders. Sir William Pearce spoke of chemical manufactories being controlled establishments and gas undertakings not; but this only applies to the war period. He should compare the dividends—thin indeed in many cases—now being paid in the gas industry with the profits that are being divided by the chemical industry, notwithstanding the participation of the nation in excess profits. He would then see whether the gas industry is at present amassing any considerable wealth by serving the country.

But the price of gas to the consumer was not the main object of the two or three members who—through generous feelings for, or pecuniary interest in, the chemical industry—desired amendments to be inserted in the Bill. They wanted all the part of the business of a gas undertaking of a chemical nature to have separate accounts assigned to it. Mr. Pretyman could not appreciate the reason for this; but it is not a difficult matter for anyone within the gas industry to discern a very positive reason. We have dealt with the point before. Sir William Pearce and Mr. King are of opinion that distinct accounts would be a preventive of speculation upon the part of the gas undertakings. What we see in the idea is a means of enabling the chemical manufacturers to commercially harass gas undertakings. When the chemical manufacturers come under statutory control, and publish to the gas industry the financial details of their working, then the gas industry would have less objection to publish, so far as is practicable in their circumstances, the details appertaining to the working-up of their secondary products. It would be a commercial advantage to the chemical manufacturers, and a commercial dis-

advantage to the gas industry, for such a one-sided arrangement as was suggested to be imposed by Parliament. The Board of Trade look at the matter from another point of view—the one mentioned above has probably not occurred to them; and the Board's point of view is the one that was submitted during the Committee stage by the Right Hon. Sir Daniel F. Goddard and Sir J. Fortescue Flannery, Bart. It is as to the impossibility, in the majority of gas undertakings, of segregating accounts for the working-up of residual products from those referring to the processes of gas manufacture. It is possible in the case of large gas undertakings that make a distinct business of chemical manufacture from the residual products; but such an operation as benzol recovery from gas is little more than a side issue of gas manufacture. Accounts, of course, are kept as far as possible of all processes on a gas-works; but the processes are so interallied that it is impossible to keep rigidly separate and exact the whole of the costs appertaining to every pendent process. Labour, for instance, is in many works distributed over several operations—some requiring more, some less, attention than others. Also the supervision of management and chemists cannot very well have part of its cost allocated to such an incidental operation as benzol recovery.

However, the Bill passed through the Commons stage without the amendments and additions suggested. Had they been accepted, those responsible for the capital and service of gas undertakings might, in defence of their interests, simply have refused to apply for the change of standard, and limited their operations in the matter of serving the country to the fullest extent that their present statutory powers permit.

The Will-o'-the-Wisp of Uncarburetted Hydrogen.

THE letter on this subject by Mr. Charles Carpenter, D.Sc., published in our last week's issue, was received too late for reference then. It was a philosophic argument; and we are with the philosopher and counsellor to the extent that it would be folly for gas undertakings to completely denude their gas of hydrocarbons, and to supply only uncarburetted hydrogen. Few, if any, gas men are likely to indulge in any such irrationality. But extremes do not obtain in one direction only; and what may not have been an extreme but a few years ago may be so now. Safety lies in a course that stops at a point before realizing a non-luminous gas. Parliament not long since in its calorific power legislation appreciated this, and provided for optional flat-flame testing "for information only," which testing outside London is already more honoured in the breach than in the observance; the reason for this being that gas suppliers are mostly business men, and realize that it would be sheer lunacy to supply a commodity of a quality that would send their customers spinning-off to another "shop." Any gas supplier who substituted "furnace gases" for hydrocarbon vapours would be a fool; those who do a bit of over-pulling, and send out a proportion of such gases, are entitled to a place in the category. "National interests" from the gas supplier's point of view are not bounded by benzol, toluol, and so on. "National interests" involve communal interests; and when the best service to the community is being rendered, "national interests" are being promoted.

When speaking of "furnace gases," Mr. Carpenter was no doubt using a term of hyperbole or of metaphor, in order to accentuate his meaning. But the times have changed; their requirements are greater; the gas industry can afford to relinquish a goodly part of the luminosity of gas; every day the gas consumer is appreciating more and more that the gas he was formerly burning is not a gas that rendered the maximum possible to the national economy, if the gas consumer himself made use of efficient gas appliances. But Mr. Carpenter evidently does not wish to yield up much of the luminosity of gas even to national economy or expediency. "Those who make straight coal gas will find they "can obtain a substantial yield of naphthas without destroying the luminosity of the flat flames—if they will but "make *straight* gas." Again, "as regards those who practise "more complete washing, it is up to them to replace, to a "large extent, what they extract by petroleum hydrocarbons "through the medium of their water-gas plants." Mr. Carpenter is a staunch defender of those who indulge in antiquarianism to the extent of employing flat-flame burners, and so flouting economy and the instructions of the Board of Trade that flat-flame gas-burners should be displaced and incandescent ones substituted in the interests of coal economy. But the defence takes the form of preserving the luminosity of gas, while persevering in the endeavour to persuade consumers to adopt the "Metro" burner. The virtues of the "Metro" burner notwithstanding, Mr. Carpenter's experience is that the gas consumer is not to be driven to the adoption of mantles. "Driven!" The character of the "push" that the gas industry has made in the matter of the adoption of the incandescent burner has not been a severe one; its gentleness is expressed by three decades and upwards of mantle existence.

And here the last paragraph of the letter has quite piquant interest. "It was seriously suggested to me the other day," writes Mr. Carpenter, "that if the flat-flame users got no "light at all, they would be driven to the adoption of "mantles. There is, of course, another possibility; and "until such times as Parliament may require the suppliers "of electrical energy to reduce their voltage by one-half and "the customers to use their present lamps, I would suggest "that gas undertakings be very careful not to be led away "from the paths of duty and safety by the 'Will-o'-the-"wisp' of uncarburetted hydrogen." Parliament is never likely to require the suppliers of electrical energy to reduce their voltage by one-half, and consumers to use lamps designed for present voltages; so that flat-flame users are to be ministered to in perpetuity. Electrical competition is not to be met, checked, and repulsed by the dearest method of gas illumination—the flat-flame burner. A low illuminating value from a heavy consumption of gas, a substantial gas account, and dirty ceilings and walls, are the best possible means of assisting the commercial interests of the electrical industry.

[As this issue of the "JOURNAL" was going to press, a letter was received from Mr. Thomas Glover. It will be found on p. 74.]

Tar Oils for Engine Use.

THE distillates of gas tar are in this country going to be sought after much more in future than in the past. There has been a large rush for the products of gas tar for the purposes of the war; the manufacturers of dyes badly want certain of its products for meeting their requirements; motor car people are looking with longing eyes to the time when the Ministry of Munitions will no longer monopolize benzol production; and now the users of Diesel engines are courting tar oils instead of residual petroleum, which, through high costs, due to the general upheaval of prices and heavy rates of freight, are out of the question now for economical running. And not only for this time of stress, Diesel engine users are, after their experience of the vacillations of the oil market, rather favourably disposed to the possession of two markets in place of one in which to purchase fuel for their engines, which are not difficult to convert so that tar oils or residual petroleum can be used at will. Crude tar (which was once advocated) is not now viewed with favour by them, inasmuch as it means dirty valves, tardy ignition, and increased labour in cleaning. This is rather an advantage than otherwise, as gas-tar producers are not likely in future to be willing sellers of crude tar either for engine, road, or any other purpose, seeing that it is in accord with the economic order of things that from it recovery should primarily be made of benzol, toluol, and other valuable constituents.

The disability of crude tar to serve in Diesel engines therefore fits in with the full development of tar uses. Succeeding the recovery from tar of benzol, &c., the fractions that are best suited to engine purpose are those which distil over at above 270° C., and have a specific gravity of from 1·0 to 1·08, a water content of not exceeding 2½ per cent. (2 per cent. would be better), not more than 2 per cent. of solid constituents insoluble in xylol, and with less than 1½ per cent. of sulphur. The sulphur in tar oils generally ranges between 0·5 to 0·9 per cent.; so it is well within the limit set by the experts. All the same, experience declares that it does not do to have tar oils in contact with engine parts made of copper or zinc, or any alloys of these metals, owing to their corrosive action. This being so, steel pipe work has to be adopted; and the engine parts usually manufactured of gun metal or phosphor bronze have to be made of pure nickel, or 25 per cent. nickel steel. As to the calorific value of the tar oils, it seems the tar distillers are not at present very willing to give any guarantee in this respect; but, according to Mr. Charles Day, in a paper before the Diesel Engine

Users' Association, the guarantee of the calorific power is not material, as numerous tests assure him that it is not a variable quantity. But when tests are produced showing a range of gross calorific value of from 15,200 to 17,800 B.Th.U. per pound, doubts arise as to whether calorific value is altogether a negligible matter. Mr. Day, too, discriminates between the tar produced in horizontal retorts and that from vertical retorts—asserting that the former contains too large a quantity of free carbon, while the vertical retort tar is more suitable. Mr. Day could not have procured tar produced in horizontal retorts under the modern system of heavy charges, or he would not have found the presence of free carbon in the quantity he unfortunately appears to have done. But he is not the only expert who favours vertical retort tar. It is preferred in Germany and Switzerland. From another source, too, it is learned that, in a "neutral country," oils from vertical retort tar are being used with every success in Diesel engines of all sizes, of both slow and high speeds, without the engines being altered for pilot ignition.

This is an interesting statement; and it would be of particular value to vertical retort tar oils if in this country it were demonstrated to be true, inasmuch as it is found (although it pays) a somewhat expensive process to provide for pilot ignition for the use of ordinary tar oils. There is, however, ground for being a little sceptical on the point as to any such intrinsic difference existing between the tar oils from vertical retort tar and from that produced by modern worked horizontal retorts. Ordinary commercial tar oils suffer the drawback of high temperature ignition—say, 580° C., which compares with 380° C. for paraffin, and 360° C. for residual petroleum. Reduction of cylinder clearance, with higher temperature of compression, and the avoidance of running at low loads are means of meeting the difficulties. But they are not altogether satisfactory. At low loads, especially, there is inconstancy of ignition. The approved system of combating the difficulty is to arrange for the passing of about 3 per cent. (some authorities go as high as 6 per cent.) of petroleum or shale oil in front of the charge of tar oil. This is accomplished by a small pump fitted in proximity to the cylinder inlet. The petroleum oil ignites, and causes a rise of temperature sufficient to ensure the combustion of the tar oil charge at practically any load. Not long since, the Electrical Engineers at Rhyl and Worthing were authorized to make the necessary additions and changes to their Diesel engine plants so as to utilize tar oils—the estimated expenditure in the case of Rhyl being about £200. Mr. Day computes that the cost of alteration averages about £1 per horse power, including the needle valve, ignition-oil pump, and controlling devices; and he reckons that this outlay would be reimbursed in a year. Embracing the 3 per cent. of petroleum required for ignition, the saving by the use of tar oil would, he says, amount approximately to 21s. per horse power per annum. The abstract of the paper does not give the prices upon which comparison is made; but, as to quantity, it is stated that the consumption of residual petroleum per brake horse power is from 0·4 to 0·5 lb., and with tar oils it is about 12½ per cent. higher. From another quarter, trial results are obtained which show that, with four various sized engines, exclusive of pilot charge, the consumption of tar oil per brake horse power was, at full load, 0·47 lb. (15,300 B.Th.U. per lb.), 0·47 lb. (15,200 B.Th.U.), 0·42 lb. (16,000 B.Th.U.), and 0·43 lb. (16,300 B.Th.U.); at three-quarter load, 0·44 lb., 0·50 lb., 0·43 lb., and 0·44 lb.; at half load, 0·42 lb., 0·55 lb., 0·48 lb., and 0·47 lb. The results for the first engine are a little peculiar, as they appear to improve as the load descended.

However, there is evidence that in the use of tar oils in Diesel engines, this country is much behind Continental ones, and tar distillers do not as yet appear to have laid themselves out for developing the demand. It was stated, in the discussion of Mr. Day's paper, that out of fifty firms who were asked for samples of and quotations for tar oils for engine work, only six offered the fuel in serviceable form, and the total so offered amounted to less than 8000 tons—the prices ranging from 2½d. to 6d. per gallon, or (say) from £2 10s. to £7 per ton. [A recent quotation for tar oils to the Gillingham Electricity Committee was £4 per ton, against £8 16s. 3d. for ordinary fuel oil—the efficiency of the former in the Diesel plant being only 10 per cent. less than that of the latter.] It may be the demand hitherto for tar oils for engine use has not encouraged British tar distillers; for it is calculated that out of something like 80,000 brake horse power of Diesel engines in this country, plant to the equivalent of only about 1000-horse power is fitted for tar oil use. Picture in contrast the position in Germany, where engines equal to some 150,000 brake horse power are fitted for the consumption of tar oils; in Switzerland, where 140 Diesel engines were before the war running on tar oils, in units varying from 20 to 1000 brake horse power; and in France, where (also before the war) several engines in units varying from 20 to as high as 3500 brake horse power were being operated by the same fuel. These figures, be it marked, apply to prior to the war, which fact shows that tar oils were then successfully competing with residual petroleum, and for small as well as high power engines. It is the business of the gas industry to develop all possible markets for its bye-products, and for the derivatives of these products. All that can be done in this way will be needed under the future conditions of high prices for materials and labour and strenuous competition.

Gas-Saving Cooker Devices.

Several years ago, we tried an arrangement on top of a gas-cooker, whereby, using one gas-ring, three or four saucepans or other utensils could be boiled simultaneously, with, so it was said, a remarkable saving of gas. But the "remarkable saving" in relation to work done did not materialize; and the contrivance was soon scrapped. The arrangement was of rectangular form, with four circular holes cut in the top, the bottom being open. When a burner-ring was lit up, and the device placed on top of the hot-plate, the flames played along the underside of the sheet-iron top, heating the utensils over the holes—but slowly, and allowing a good deal of heat to escape from the sheet iron by radiation and conduction. Lately, there has been a revival of similar pseudo gas-saving articles; and they have had a very large amount of publicity among the advertisements in popular newspapers. "Wonderful inventions" they are called; and the "revolution" they are supposed to be capable of effecting in cooking is also awarded the epithet "wonderful." There are various forms of these auxiliaries to the gas-cooker top; and the public are told that they are capable of saving 75 per cent. of gas, and therefore 15s. in the pound formerly spent on gaseous fuel for the cooker. If this were truly so, there would be nothing that could stand in competition with the gas-cooker, surmounted by one of these contrivances. The vendors of one of these arrangements show in their advertisements a cooker with a multitude of jets flaring away; and among the "facts" that they present is that, employing a gas-cooker without their contrivance, something like 120 cubic feet of gas are used in cooking the average dinner. This is a matter that the British Commercial Gas Association should look into, for the purpose of correction.

The Result of a Boiling Test.

The combustion of gas at a ring or other burner generates a certain number of heat units; and these heat units are only capable of doing a certain amount of work. No appliance such as is advertised can raise the heating capacity of the gas consumed. Of course, the idea that the vendors wish to convey is that, by the aid of their contrivance, the gas is put to better use; and it is through this better use that the saving is effected. We have before us the results of some tests that have been made with one of these 75 per cent. gas-saving devices. The method employed in testing was as follows: A definite amount of gas, measured by a laboratory meter, was consumed through one burner under the device according to the directions supplied by the makers. The initial and final temperatures of a weighed quantity of water were noted; and the calorific value of the gas used was also taken (514 B.Th.U.). From the data collected, the thermal efficiency was found—first using two utensils, then three and four respectively. The method was repeated, using the same utensils direct on to the cooker hot-plate. The figures before us show that, when the "gas-saving" device was used for boiling water, *more than double the amount of gas had to be burned*, which is not what the makers claim. Their claim is a 75 per cent. saving! In boiling water—equal quantities, in an equal number of utensils—the consumption with the device was upwards of 100 per cent. greater than without it! With two, three, or four utensils, the heating is slower than when it is performed in utensils over individual rings. The heat losses, through this longer time, are greater from the "gas-saving" device and the utensils. The gas

industry ought not to allow the public to be deceived in the manner that is now being done through these advertisements, for two reasons: The first is that the advertisements convey the impression to the lay mind that the existing gas-cooker wastes 75 per cent. of gas; and the second is that it is the business of the industry to do all possible to protect their consumers against the use of uneconomical gas appliances—whether for boiling or any other purpose.

Tar Distillation and Pitch Burning.

The opening lines of the paper (of which an abstract translation is given in other columns), on "Coal Tar and its Distillation," which M. Zollikofer, of the St. Gall Gas-Works, read at the recent meeting of the Swiss Association, contain some figures which are peculiarly interesting. Of the total make of coal tar in Switzerland in 1913, 56·7 per cent. was exported, and of this no less than 78·5 per cent. went to Germany. It would be instructive if one also knew the aggregate annual importations of coal tar by Germany. It must have been something immense, for the satisfaction of its extensive dye, colour, and chemical industries. If the countries outside Germany in future do their duty, and themselves develop to a larger extent these and other industries for which tar is the raw material, they will not have much, if any, of the commodity to spare for Germany. It is also seen that Switzerland has enjoyed, like other countries, a better revenue from tar. A few years ago the commodity fetched 16s. 3d. per ton in Switzerland; now it sells for more than double this price—the rise being due to the application of tar to road purposes, and the employment of tar oils in Diesel engines, which latter subject is dealt with in an editorial article. The practice of tar distillation is now extending in Swiss gas-works; and a description of processes and product results is the main object of the paper. In the discussion, information was given as to the tar-distillation plant at the Zurich Gas-Works, where (owing to the present poorness of the market) pitch is being used as fuel for raising the temperature of the superheater. This is provided with a liquid fuel burner for tar oil, which, however, now realizes a good price, and so hard pitch is employed as the fuel. In using pitch the compressed air for the atomizing of fuel is maintained at a temperature higher than the melting-point of pitch. M. Escher, who gave these particulars, also mentioned that molten pitch is as fluid as tar at the temperatures at which it is ordinarily employed for heating purposes, and that there are no insuperable difficulties in utilizing pitch for fuel in industrial work in the same way as tar is now actually employed in metallurgical furnaces. At the last meeting of the Midland Association, Mr. W. Chaney gave some information as to the utilization of pitch for boiler fuel.

Testing Gas-Cookers.

A copious amount of work has been expended upon the testing of the radiant and hygienic efficiency of gas-fires; but the standard method of testing radiant efficiency has not yet been put on a definite basis. But there has been very little work done in relation to the testing of the heat-efficiency of gas-cookers; and that little has been of a somewhat crude order, and has shown that here the experimenter is faced with a somewhat intricate problem. Although knowing that in the gas-cooker we have one of the most prolific, practically all-the-year round, sources of consumption, the gas industry has taken no steps to devise a rational method of gauging the relative merits and efficiency of the several makes. While there is this negligence, the electric-cooker producers are incessantly pressing on with the work of raising their productions to the highest pitch of perfection that is permissible with the low thermal value current which they oppose to gas. In oven efficiency, they have realized a certain amount of success; but the seats of considerable weakness are the boiling-discs. Though B.Th.U. are cheap with gas, we must not allow the electric-cooker to make headway through indifference to the thermal efficiency of the gas-cooker. The first thing that requires to be done is to determine an acceptable system of testing. This is a matter that Mr. Stanley C. Farrar, A.R.C.S., B.Sc., discusses in other columns; and he not only suggests a method of oven testing, but he indicates the difficulties that disturb the attempts to realize certainty in the results. The system of oven testing most generally in use is to ascertain the consumption of gas per cubic foot of oven space in order to maintain a given temperature with the thermometers in certain positions. Mr. Farrar proposes that the result should be expressed in calories needed per cubic foot of space; but it would be better still, as British units have been adopted for the parliamentary standard of calorific power, to give the result in B.Th.U. required per cubic foot of space. Besides calorific power, there are other factors that have to be considered. There are, for example, the degree of equality of the distribution of heat in the oven, and the time under given atmospheric conditions that is required in order to reach the desired temperature. The suggestions made by Mr. Farrar are worthy of discussion, on account of the imperative need for taking up this matter systematically and scientifically, and not allowing it to drift any longer. Mr. Farrar only incidentally mentions hot-plate burners. It may be submitted that these constitute the place where there is room for the greatest economy, and therefore for investigation and ingenuity.

Education of Engineers.

Once more the need for greatly increasing the volume of research work is being emphasized, on this occasion in connection with the British engineering industry. Some time ago a Sub-Committee was appointed by the Council for the Organization of British Engineering Industry, to report on engineering education and research; and this they have now done—indicating means for the furtherance of this educational and research work. The recommendations which they make in the course of their report include: The organization of the engineering industry by the federation of British manufacturing engineers for purposes which include education and research; the co-ordination of existing means for educating engineers, and particularly the provision of an adequate and more uniform system of scholarships; the re-consideration of the conditions for admission to universities; and the reform of university teaching. In drafting up their report, the Sub-Committee have all along kept in view the need for applying to the education of engineers the same principles of continuity as is found in every branch of physical science; and, in accordance with this principle, they believe, as most other people no doubt now do, that the last two or three years of every person's whole-time education should have the specific aim of preparing him for his particular walk in life (so far as it can be foreseen), but without, of course, undue specializing. Suggestions are offered in regard to training apprentices; and, finally, the Sub-Committee recommend, as some of the means by which the amount of research work carried out in connection with the British industry may be increased, that university teachers should be encouraged to undertake research on behalf of, and in co-operation with, manufacturing firms—additional Government grants being paid with this end in view, and that provision should be made for the increased activity desired by fully utilizing and extending existing facilities, as well as by establishing a central research laboratory for investigations that cannot be carried on elsewhere.

Refuse Material for Producer-Gas Sets.—In a paper recently issued by the Bureau of Mines of the United States, it is pointed out that within the past five or six years marked progress has been made in Europe in the utilization of various kinds of refuse material not ordinarily given much consideration. The manufacturers of gas-producers report the successful use of a large variety of fuels—including wood shavings, wood blocks, sawdust, excelsior, coffee husks, rice husks, cocoanut shells, straw, and spent tan bark. The figures as to fuel consumption reported by the manufacturers are about as follows: With reasonably dry wood (say, mixed oak, ash, and elm) the consumption has been as low as 2 lbs. per B.H.P.-hour; with sawdust the consumption averages 3½ lbs.; and with spent tan bark, containing 50 per cent. of moisture, it is about 4½ lbs.

American Gas Institute "Transactions."—The tenth annual meeting of the American Gas Institute, which was held in San Francisco in September of last year, was in many respects a memorable affair, coinciding, as it did, with the Panama-Pacific Exposition. The President was Mr. E. C. Jones, who pointed out in the course of his address that, on account of the Institute's participation in the International Gas Congress, the proceedings at the meeting would consist mainly of the reports of Committees, and that the occasion had been chosen to prepare an index of the "Proceedings" of the past decade, covering the life of the Institute. The official report of the meeting in volume form, edited by the Publication Committee, has now been prepared; and we have to acknowledge the receipt of a copy. Prefaced by a portrait of Mr. Jones, the report, with the constitution and bye-laws of the Institute and a list of members, fills a substantial volume. The index to Vols. I. to X—1906 to 1915—of the "Transactions," which was referred to by the President, has been bound up separately in a book of 120 pages, thus simplifying reference, which is further aided by the extreme legibility of the type that is employed.

CITY AND GUILDS EXAMINATIONS.

No Names of Successful Candidates Available.

In a letter addressed last month by Mr. L. G. Killby, of the City and Guilds of London Institute, to Mr. Walter T. Dunn, the Secretary of the Institution of Gas Engineers, it was intimated that, owing to the great shortage of their staff, it would be quite impossible for the department to supply the lists of successful candidates which had been readily furnished in normal times. The total results will, it was added, appear in due course in the report on the work of the department which it is hoped may later on be issued, even though it may be in a very abbreviated form.

Mr. Dunn, in sending a copy of Mr. Killby's letter, mentions that the totals of those who took part in the examinations were given in the Institution Council's report—see "Journal" for May 23, p. 393. They were: Gas Engineering, Grade I., 62; Final, 46. Gas Supply, Grade I., 58; Final, 37. Gas Fitting, Grade I., 46; Grade II., 65; Final, 36. No intimation as to the total number of successful students will, it seems, be given till the autumn; and even then no names will, as at present arranged, be available.

In view of this, we venture to ask the teachers in the various local centres, and any others able to do so, to be good enough to forward for publication the names of those who, they know, have been successful in passing any of the three gas examinations.

OBITUARY.

Captain Stanley T. A. Neil, of the West Yorkshire Regiment, who has been killed in action, was before the war Resident Engineer at the Leeds New Leighton Reservoir. He joined the battalion upon its formation, and was temporarily in command of it.

The death occurred at Llandudno, on Monday of last week, at the age of 72, of Mr. James Maddock, J.P., of Burslem. After leading an exceedingly active life for many years, he was content in his later days to limit his attention to the conduct of his own business and the duties devolving upon him as Chairman of the Staffordshire Potteries Water-Works Company, of which his father was one of the original shareholders, and his son is also a Director. Many years ago, he was Mayor of Burslem; and in connection with his municipal duties, he was an excellent Chairman of the Gas Committee. It was, indeed, said later that the ability he always displayed in the directing of the Potteries Water Company's affairs had its origin in his experience at the head of the Burslem gas undertaking.

PERSONAL.

Mr. H. D. Ellis, formerly Secretary of the Commercial Gas Company, has been appointed a member of the Board of the Tottenham District Light, Heat, and Power Company; and the Right Hon. Sir Daniel F. Goddard, M.P., has been elected Chairman of the Company, in place of the late Sir Corbet Woodall.

Professor Arthur Smithells has been appointed to the War Office staff, with the temporary rank of lieutenant-colonel, but graded for pay as a deputy assistant adjutant-general.

We learn that Mr. F. C. Briggs, of the Gas Light and Coke Company, and a Vice-President of the London and Southern District Junior Gas Association, has been appointed Engineer and Manager to the Dudley Gas Company, which position was rendered vacant by the death of Mr. G. A. Collins.

After fifty-five years' service in the business, Mr. J. W. Glover, the Managing-Director of Messrs. George Glover and Co., Limited, is retiring. It will be remembered that he was present at last month's meeting of the Institution of Gas Engineers, and made some practical remarks on the report of the Life of Gas-Meters Committee, of which he is a member.

Mr. H. Dobson, who has for some while been with the Aldershot Gas, Water, and District Lighting Company, has been appointed Working Manager to the Uppingham Gas Company.

Second-Lieutenant A. Ball, who is to receive the Military Cross for splendid work performed in France in connection with the Flying Corps, is the eldest son of Alderman Albert Ball, the Chairman of the Nottingham Corporation Gas Committee. Lieutenant Ball, who is only 19, has rendered admirable service in bringing down German machines, and upon more than one occasion has earned the special commendation of high military authorities.

The Board of Trade announce that, in view of the wide range of the industries included within the scope of the Committee appointed to deal with the position of the iron, steel, and engineering trades after the war, and in order to expedite the inquiry, the President has decided to subdivide the work of the Committee between two Committees, dealing with the engineering and the iron and steel trades respectively. Sir Hallewell Rogers is a member of the Committee for the Engineering Trades.

Intimation has been received from the War Office that Second Lieutenant A. V. Ratcliffe, of the 10th West Yorkshire Regiment, is "missing, believed wounded." He is a nephew of Colonel Brotherton (the Chairman of Messrs. Brotherton and Co., Limited, of Leeds), and brother of Mr. Charles F. Ratcliffe (the Managing-Director). Mr. Ratcliffe's youngest brother, Lieutenant B. L. Ratcliffe, of the 1st West Yorkshire Regiment, was wounded and captured at the battle of the Aisne in September, 1914, and is now a prisoner of war at Ingolstadt, Bavaria.

The marriage of Miss Phyllis Hack, youngest daughter of Mr. and Mrs. T. H. Hack, to Mr. A. Gripaios, of Cardiff, which took place at Christ Church, West Bromwich, on the 29th ult., aroused great interest at the Swan Village works of the Birmingham Corporation Gas Department; and the workmen and staff decided to make a present to the bride, in honour of the occasion. On the eve of the wedding, Messrs. Martin and Burton accordingly visited the Engineer's residence, and asked her to accept a large electro-plated waiter with engraved centre, inscribed "Presented to Miss Phyllis Hack by the staff and workpeople of the City of Birmingham Gas Department, Swan Village Works, on the occasion of her marriage, June 29, 1916." Miss Hack returned thanks, and Mr. Hack said he took it as a personal compliment that the presentation was made, and very much appreciated the feeling which had prompted it. On the previous Monday, the women employed on the works presented Miss Hack with a silver epergne.

Last October, when the Middlesbrough Gas and Electricity Committee recommended that Mr. David Terrace (the Manager) should be appointed Consulting Engineer of the gas-works, at a salary of £250 a year, and that Mr. G. F. Blencoe (the Assistant Manager) should become Manager, at a commencing salary of £300, the Council decided to leave the question of control in abeyance for twelve months. The settlement of the matter has, however, been hastened, because of Mr. Blencoe having been "in the running" for another appointment in a neighbouring town. At a special meeting of the Committee last Tuesday, the matter was fully discussed, and members spoke in terms of high appreciation of the services to the town of both Mr. Terrace and Mr. Blencoe. Mr. Terrace expressed acquiesence in a re-arrangement by which Mr. Blencoe would become Manager and he Consulting Engineer; and it was unanimously agreed that from Oct. 1 Mr. Blencoe should be Manager at a commencing salary of £350 per annum, and that Mr. Terrace should be appointed Consulting Engineer for two years at a salary of £250 per annum. Mr. Terrace also agreed to continue during this period to look after the rectification of a holder which is to be repaired. It is expected that the Council will this evening be asked to confirm the arrangement.

Mr. Thornton and the Society of British Gas Industries.

A dinner will be given this (Tuesday) evening by Mr. H. M. Thornton, J.P., the Chairman of the Society of British Gas Industries, to the Council of the Society and a few friends to meet the President, the Right Hon. H. E. Duke, K.C., M.P. Among those who have accepted the invitation to be present are:

Mr. J. H. Balfour Browne, K.C.
The Rt. Hon. Sir Daniel F. Goddard, M.P.
Sir David Burnett, Bart., who was Lord Mayor of London at the time of the recent gas exhibition.
Sir John Bethell, Bart., M.P.
Sir Ernest Lamb, C.M.G., M.P.
Mr. A. W. Hazel, M.A., D.C.L., the Recorder of Stoke-upon-Trent.
Mr. A. E. Broadberry, M.Inst.C.E., the President of the Institution of Gas Engineers.

South Metropolitan Co-Partnership Bonus.

Pointing out in the "Co-Partnership Journal of the South Metropolitan Gas Company" that the bonus to be declared for the past year is the lowest on record, being down to 2½ per cent. on the salaries and wages, Mr. Charles Carpenter, D.Sc., says the causes of this are not far to seek, and are known to most co-partners as directly arising out of the war. Shareholders in gas undertakings stand out, almost alone, among proprietors of the leading industries of the country as heavy losers, instead of increased profit makers, by reason of the terrible conflict now being waged, despite the fact that it is to the gas-works the Government have turned for the products of coal distillation so essential for the manufacture of explosives.

The will of Mr. Arthur J. Dickinson (whose death was recorded in the "Journal" for May 16) has been proved at £21,992 net personalty.

In Holland, the distribution of artificial manures is in the hands of a Special Committee; and the greater part of the sulphate of ammonia produced in the country is sold to this Committee. Owing to the irregular arrivals of nitrate of soda, prices of nitrogenous fertilizers have gone up considerably. Though the regular prices of sulphate do not much exceed £25 per metric ton, there has been paid in the open market as much as £40 per metric ton, on the 20 per cent. nitrogen basis.

LOCAL TAXATION.

In the financial section of the forty-fourth annual report of the Local Government Board—other portions of which were referred to in the last issue of the "Journal"—it is said that the number of local authorities in England and Wales who had financial transactions during the year 1912-13 [the latest date to which the returns have been compiled] was 25,393.

The aggregate expenditure, apart from that defrayed out of loans, was £140,337,532, of which £33,414,729 consisted of loan charges, apportioned as far as practicable. Among the items of expenditure, there appear: Electric lighting, other than public lighting, £4,742,121 (£2,480,940 being loan charges); gas-works, £7,790,009 (including £1,584,385 loan charges); public lighting, £2,289,878 (loan charges, £20,610); and water-works, excluding the Metropolitan Water Board, £5,966,578 (£3,992,991 loan charges). The item of loan charges comprises interest on borrowed money, repayments of principal made otherwise than out of the sinking funds, and payments into sinking funds.

On the other side of the account, the aggregate receipts of the local authorities, other than receipts from loans, were £140,322,200, of which the public rates accounted for £68,212,608. Then there were the following revenues, other than from investments of sinking funds: Water supply undertakings (water-rates, &c.), £5,469,857; gas supply undertakings (gas-rentals, &c.), £8,590,198; electricity supply undertakings, £4,821,506. It should be noted again that, under the heading of water, the receipts of the Metropolitan Water Board are not included.

Turning now to the table referring to loans, it is seen that the loans outstanding at the end of 1912-13 totalled £557,321,337—in this instance, including loans accounted for by the Metropolitan Water Board. Of this total, £30,314,876 was for electric lighting, other than public lighting; £22,456,595 for gas-works; £179,797 for public lighting; and £130,598,532 for water-works. The loans raised during the twelve months were £17,512,923, of which £1,629,801 was for electric lighting, £482,824 for gas-works, £5702 for public lighting, and £1,767,495 for water-works. Of the total amount that was expended over the year out of loans, £1,644,888 was on account of electric lighting, £475,792 of gas-works, £6903 of public lighting, and £1,989,091 of water-works. The amount standing at the end of the year 1912-13 to the credit of sinking funds (including redemption funds and the portions of loans funds which are applicable to the repayment of loans), towards the repayment of the part of the loans which is repayable by means of these funds, was £34,697,358.

The amounts in the pound of the total rates levied in London during the year ranged from 6s. 4d. in one parish to 11s. 3d. in another; while in county boroughs the figures ranged from 4s. 7¼d. in one case to 10s. 6d. in two others. As a matter of fact, the amounts in the pound of the rates in a few differentially rated parts of county boroughs were lower than 4s. 7¼d.; and in one of the parishes of a county borough the rate was 11s. 3d. There were similar differences, of course, in other groups of areas. The average amounts per pound of valuation of poor rates and general rates were: London, 7s. 0·5d.; county boroughs, 7s. 4·4d.; other boroughs and urban districts, 6s. 10·9d.; rural districts, 4s. 9·2d. The figures per head of the estimated population were: London, £3 10s. 2d.; county boroughs, £1 16s. 9d.; other boroughs and urban districts, £1 12s. 1d.; rural districts, £1 7s. 7d.—the general average being £1 17s. 4d.

It is remarked that the proportion which the amount of the outstanding loans of local authorities bears to the population and rateable value of the several areas in respect of which the loans have been incurred, varies greatly in the different localities. Naturally, it is greatest in the localities in which harbours, docks, and gas, water, electricity, and tramways undertakings have been acquired or constructed out of moneys borrowed by the authorities. Between the end of the year 1911-12 and the end of 1912-13, there was a net increase of £750,198 (equivalent to no more than 0·1 per cent.) in the total amount of the loans outstanding against local authorities. Calculation shows that whereas in 1884-5 the amount of loans owing in respect of works which were or might be reproductive was £3 0s. 9d. per head of the estimated population, by the end of 1912-13 the corresponding figure had risen to £7 15s. 2d. At the latter date, the total amount of loans outstanding (for all purposes) was £2 10s. 5d. per pound of rateable value, and £15 5s. 10d. per head of the estimated population.

World's Production of Fertilizers.

The International Institute of Agriculture have published an extensive table showing the world's production of fertilizers; but it only carries the statistics down to the end of 1913. Later figures are available, they say, for the production of certain of the items in different countries. For example, the production of sulphate of ammonia was as follows: France, 91,500 tons in 1914 and 42,000 tons in 1915; Italy, 14,323 tons in 1914 and 15,000 tons in 1915; Sweden, 1510 tons in 1914; United Kingdom, 433,235 tons in 1914 and 429,768 tons in 1915; United States, 166,015 tons in 1914 and 192,323 tons in 1915; Germany, 413,837 tons in 1914. In 1914 Italy produced 22,500 tons of calcium cyanamide, and Norway 14,670 tons.

ELECTRICITY SUPPLY MEMORANDA.

Intimation was made at the recent meeting of the Incorporated Municipal Electrical Association that there is a prospect of further litigation over the question of preferential charges. We had imagined that electric undertakings had had sufficient judicial interpretations of their powers of charge; but if they are not satisfied, the Law Courts are, of course, open to them, and legal friends are perfectly willing to pocket further fees. The Hon. Secretary of the Association (Mr. Faraday Proctor) introduced the matter. The Hackney Borough Council electricity undertaking is the one which the gas suppliers in the area allege are acting *ultra vires* by giving preference. According to Mr. Proctor, the case is the exact converse of the Long Eaton one. The assertion is that the undertaking shows preference by allowing lighting consumers a lower rate of charge when power is taken; while the Long Eaton Council were brought to book for reducing the charge for power when current was also taken for lighting. Mr. Proctor was exceedingly careful how he referred to the matter. It seems to us, from his statement of the salient fact, that Hackney and Long Eaton present a difference without a distinction. Whether or not this is so, the Judges must decide if the combined wisdom of the Hackney Council and their legal advisers cannot determine the point. There seems to be a little doubt in existence somewhere or other as to whether the action should be defended; for Mr. Proctor made use of an "if." "If" the case was fought, he is reported to have said, it was desirable that the Association in general meeting should promise their moral support to Hackney, and also, if need be, financial assistance. A resolution to this effect was passed, which indicates that the members of the Association are desirous that the matter should not be left where it is, but that any little variation from precedent should be contested. The Long Eaton case went to the Court of Appeal; and perhaps some of the members of the Association would like to see the question carried by Hackney to the House of Lords. We think it was over the Ilford case that the Association previously intervened, and canvassed local authorities for subscriptions in order to help to support the case of the Council. This interference was of no avail; for the Ilford Council collapsed all along the line of charges set out against them.

Another Threatened Preferential Charge Case.

When one considers that a saving of 1 per cent. in the coal bill of large generating stations like those at Glasgow means a saving of £2000 a year, it will be appreciated how important is boiler-house economy and the utilization of the most efficient generating plant. The improvement in boiler-house economy, with the efficiency of the steam-turbine for stations generating on the large scale, have been in these days of dearer fuel a godsend to electrical engineers who are fortunate enough to be located in good electricity absorbing districts. But all are not so situated; and those who are not are to be pitied on the ground that high economizing plant is not within their reach. In the "Journal" for the 27th ult. (pp. 690-92), some references were made to a paper, read before the Incorporated Municipal Electrical Association, by Mr. W. W. Lackie, the Electrical Engineer of Glasgow, upon boiler-house design and operation. From the paper, it is seen how large electricity stations are benefiting considerably by the progress in boiler-house operation, which has resulted in greater efficiency on less ground space. Of course, all station engineers, whatever the magnitude of their operations, can exercise control by the aid of CO_2 recorders and thermometers and pyrometers, so as to maintain strict supervision over the combustion of fuel and the temperatures of superheated steam; but it is not all engineers who can hope to obtain the advantage of an increase in boiler pressure from 160 and 200 to 250 lbs. as is the case at one station in Chicago, nor who can hope to realize the use of the newer designed water-tube boilers, worked in conjunction with special economizers, and obtain an evaporation of water per square foot of heating surface in the boiler at the rate of 6 lbs. normal load and 8 to 10 lbs. at overload, instead of the hitherto standard efficiency of 4 lbs. Another economy which the large stations can achieve is in respect of mechanical handling; and this is a matter which is of especial interest to gas engineers who have, as a rule, to handle considerably greater quantities of coal and other materials than the electrical engineers of their localities. Mr. Lackie's figures for electrical operation in coal handling are of great interest, and they would have been of more interest still if he had given the details of the costs that he mentioned and of the energy expended. Prefacing the point, he strongly advised electrical engineers to work for two to four months' fuel storage. He has a preference for the electrically worked transporter and grab for fuel unloading and storage. At one of his stations, he has a transporter fitted with a 1-ton grab, the capital cost of which was £2600. It handles coal at the rate of 40 tons per hour; and the cost of energy, labour, and repairs brings the outlay on handling to just under 1d. per ton. At another station, truck-loads of coal are elevated 30 feet at one end of the store to a platform, from which the coal is tipped into an overhead hopper or to the coal-store; and the empty trucks are lowered by a second elevator at the other end of the store. The two elevators complete, with

Economies in the Boiler-House.

electrically operated capstans, cost £2000. The inclusive cost of handling coal in this instance is 3¼d. per ton; the higher cost being due to the labour necessary for handling the trucks. These figures are conclusively in favour of the transporter.

Buying Coal on Calorific Value.

A further subject on which Mr. Lackie uttered some cautionary words is as to buying coal for steam-raising purely on a calorific value basis. He very properly points out that this alone is insufficient, and that the physical properties of the coal should also be taken into account. Two samples of different coal may show an approximately similar calorific value under test, but present wide differences of behaviour in the furnace. A coal of good calorific value may have a high volatile matter content; and in the furnace a substantial proportion of the calorific value is expended in bringing the fuel up to the proper condition of incandescence, besides which the deposit on the fire-bars is often not negligible. These are considerations bearing upon the use (with good forced draught) of coke, which does not suffer from the disadvantages named. In the discussion, it was learned from Mr. S. E. Fedden, of Sheffield, that electrical engineers are at present experiencing much the same inferiority in coal as gas engineers complain of; but it is, of course, a case now of getting what one can. Since the war started, the calorific value of coal delivered at the Sheffield electric generating stations has dropped, and the ash content has risen. In one case the calorific value went down from 11,700 to 9700 B.Th.U. per lb.; and the ash content increased from 10 to 25 per cent. From another colliery, the coal has shown a reduction from 11,000 to 9800 B.Th.U.; while the ash has increased from 11 to 20 per cent. With the high costs delivered, and the deterioration of quality, it is not surprising that generating costs are showing material increases, and that the consumption of fuel per unit of electricity generated is higher. Of course, where new high efficiency plant has been introduced, the advanced prices and inferior quality are not felt to the same extent.

Gas Firing of Boilers.

In the discussion on the paper (as the report published in the "JOURNAL" for June 27 showed), there was further talk of the use of gaseous fuel for electricity generation. The fuel economy campaign, and the realization by electrical engineers of the tremendous waste of valuable commodities that result from the burning of raw coal under their boilers, have revived consideration of the question of the adoption of the carbonization of coal, the utilizing of the gas for the provision of steam for use with turbine generating plant, and the recovery of the secondary products. Some engineers are looking with favour upon this; others equally far-seeing are unfavourable, but are looking to the utilization of coke, which, from the fuel economy standpoint, appears to be the more rational course. The matter was raised by Mr. Lackie, who told in his paper how experiments at the Glasgow Gas-Works with coke breeze on chain-grate stokers, with forced draught, have proved successful. The breeze, he stated, can be bought at 20 per cent. of the price of coal, and has a calorific value at least 60 per cent. of that of coal. The breeze, he added, contains a large amount of ash; but with intelligent superintendence, good results can be obtained, although the actual output of the boilers is considerably reduced. Of course, coke just now is at a higher price than usual, owing to the conditions of the fuel market; but it has, generally speaking, a lower ash content than breeze. The chief interest, however, of the discussion is found in a scheme that Mr. J. Christie, the Electrical Engineer of the Brighton Corporation, is hoping to bring to a successful issue. There are, however, in that scheme, a few considerations as to the problematical outcome to which Mr. Christie did not call attention, perhaps because they have not occurred to him. He has his eyes on a low-temperature system of carbonization, and on a contract with the Coalite Company, for the use of the gas produced from the carbonization of 200 tons of coal a day. Mr. Christie speaks as though this is quite a new idea. He says that the production of coalite as fuel to meet the industrial and domestic requirements would solve the smoke problem in our large cities and towns. What about gas and—forgive the joke!—electricity for heating? There would also be the recovery of rich tar, sulphate of ammonia, toluol, and benzol, and other valuable residuals, "which are at present wasted," and "which would enable us to foster new chemical industries in our own country and supply districts." Has Mr. Christie overlooked the existence of gas-works which have been carbonizing coal, utilizing the gas and coke, supplying sulphate of ammonia for fertilizing purposes, and raw materials to several industries long before he entered on electrical engineering? Let us look at his proposal from the points of view of fuel economy and of the risk to the generation of electricity at Brighton. The quantity of gas that will be produced from the carbonization of the coal by the low-temperature system is only about one-half that yielded by the ordinary gas-making processes. True, it has a higher calorific value per cubic foot; but we do not know that the higher calorific value is going to have a proportionate value in steam-raising over ordinary town gas. But the gas has not (owing to the lower quantity) anything like the same calorific value per ton of coal carbonized—taking (say) an average production of 12,500 cubic feet per ton of coal in ordinary gas-works practice, and a calorific value of (say) 520 B.Th.U. per cubic foot. Now Mr. Christie says that with the gas from a coalite plant using 200 tons of coal per day, he hopes to produce 30,000 units. Assuming that with modern steam and generating plant 3 lbs. of coal are used per unit of electricity, the production of 30,000 units would require only 40·18 tons of coal to be transported to Brighton and there handled, compared with the 200 tons by the coalite system.

The Risks.

A contract is a good legal instrument; but this is a case in which there are certain risks. The Coalite Company is not a statutory concern the same as the local Gas Company and the Electricity Department. It is nothing more nor less than an ordinary trader; and, as its history has proved, it is subject to all the risks of ordinary traders. Where an ordinary trader cannot make a business pay, he has simply to "shut up shop;" there is no other course open to him. The success of the Brighton scheme from the Electricity Department's point of view depends on the price that Mr. Christie would have to pay for the gas; and the continuance of the production of the gas depends not only upon the price obtained for it, but upon the revenue from coke (containing a percentage of volatile matter somewhat in excess of that in ordinary gas-works coke) and from the other products. Is there any assurance that, when the conditions of the coal market return to normal, coalite is going to have a sale and realize the price in Brighton that will be necessary to commercial success? Beyond this, can Mr. Christie tell us what is going to be the position of sulphate of ammonia after the war? Sulphate of ammonia from coal carbonization will, so far as can be seen, always produce a profit, but not so much as now or before the synthetic processes of fertilizer production (in which Germany is so largely interested) came on to the scene, and the full power of which, limited only by the ability to produce a profit, will stream out upon the markets of the world soon after the war is over. We do not know the temperatures at which it is intended to carbonize coal in the proposed Brighton coalite plant; but in connection with benzol and the other products of low-temperature coal carbonization, Mr. Geoffrey Weyman, M.Sc., lately wrote ["JOURNAL" for May 9, p. 274]: "Among the so-called economical processes which have recently been brought to notice are those in which low-temperature carbonization is the principle. Unfortunately, these processes give us the primary products of coal distillation—viz., the paraffins rather than the benzenoid compounds. Until some additional means are available of converting the former into the latter, or of separating them, the idea is likely to lie dormant. . . . The usual temperature of low-temperature carbonization is too low for an efficient recovery of ammonia, while the gas evolved is too rich for town consumption. The fuel also is wasteful in that it contains volatile matter which might be more profitably used. No substance should be burnt that can be converted into useful products." The ability of the Coalite Company to make a success of a venture of the kind at Brighton does not rest on the supply of gas to the Brighton Electricity Department, but upon the commercial success attending the sale of coalite in competition with other fuels—particularly coal, gas, and gas coke—and of the other products. This is where the risk to the Brighton Corporation Electricity Department would come in. However, on going further into the matter, perhaps the warmth of Mr. Christie's infatuation may diminish, though we do not see that any good service is being rendered by us to the Brighton Gas Company in calling attention to certain risks over which the Electricity Department should assure themselves, and get absolute guarantees, before entering into a definite contract. We will say this, however, that there is no reason why the coalite process should not yield as good results as any other low-temperature carbonization system.

Society of Chemical Industry.

The annual general meeting of the Society will open in the hall of the University Union, Edinburgh, on Wednesday, the 19th inst., with an address by the President (Mr. Charles Carpenter, D.Sc.). On that and the following day there will be morning and afternoon sessions, and a morning sitting on Friday, with excursions in the afternoon. An informal dinner is to take place in the Balmoral Hotel on the Thursday evening. Arrangements are being made for an exhibition on a moderate scale during the meeting of British-made dyes, glass, and porcelain. Among the lengthy list of papers to be submitted, the following will be of particular interest to "JOURNAL" readers: "Some Recent Improvements in Coke-Works Practice," by Dr. G. P. Lishman. "Waste in Coal Production," by Professor Henry Louis. Professor W. A. Bone, F.R.S., will also contribute a paper. "A Short Review of the Influence exerted by the War on the Tar Distilling Industry," by Mr. W. H. Coleman. "The Extraction of Tar Fog from Hot Gas," by Mr. G. T. Purves. "The Progress of the British Rare Earth Industry during the War," by Mr. S. J. Johnstone. Mr. Carpenter has been nominated to occupy for a second year the office of President.

Gas-Heating in Machine Boot-Making.—The "Journal des Usines à Gaz" mentions the satisfaction expressed by M. Sademe, a Paris manufacturer of boots, with gas-heating for the various operations in boot-making—in particular for keeping at a uniform temperature the boxes of resinous mixture used for rendering both leather and thread less permeable. For running seventeen machines, the gas consumption per ten-hour day is only 6 cubic metres, corresponding to four hundred pairs of boots, or 0·003 fr. per pair.

THE TESTING OF GAS-HEATED COOKERS.

By Stanley C. Farrar, A.R.C.S., B.Sc., D.I.C.

The increasing popularity of gas-heating appliances for domestic uses has led to a demand, on the part both of the gas companies who sell and of the public who buy for some authoritative statement of the relative merits of the different appliances. The manufacturers, having found it to be to their interest to meet this demand, have attempted to devise methods of testing their goods on a scientific basis. In the last few years they have made good progress; but they are still a long way from their goal. To reach this goal four factors are essential:

(1) The manufacturers must agree to the adoption of a standard method.
(2) The method must be based on scientific principles.
(3) The results of tests must be given in such a form that they are comparable for different varieties of the same article.
(4) The tests must be carried out by scientifically-trained workers.

So far the greatest advance has been made in the testing of gas-fires; but there is still much room for improvement, particularly in regard to item (1). At present, several methods are in use, all of them perfectly sound in principle, but giving different results, due to the fact that they depend primarily on the absorption of radiant energy by a blackened body. Unless the absorption co-efficient of the body is accurately determined and allowed for, no two instruments will give the same result for the same fire. Some steps have already been taken to induce manufacturers to adopt a standard method.

The necessity of item (3) may be indicated in the case of gas-fires. A sound test could be devised based on the heating capacity of a fire; but to give the results in the form of so many cubic feet of gas per hour required to maintain 100 cubic feet of room space at 65° Fahr. (say) without making allowance for the number of exposed walls or the number of changes of air per hour would be useless.

Compared with the testing of gas-fires, the testing of gas-cookers has not received anything like the attention it deserves; and it is the object of this article to direct attention to the need of a standard method for testing cookers, and to indicate one which is based on sound principles.

The most satisfactory test, and the one which is in most general use, is that whereby the amount of heat required to maintain an oven at a certain temperature is ascertained; the result being generally given in the number of cubic feet of gas required per cubic foot of oven space. It may be pointed out that to get results, even for the same oven, that are comparative, this result should be converted into calories required per cubic foot of oven space. But to ensure getting comparable results, there are several other conditions which should be observed. The writer has always tested cookers under the following conditions: The oven is maintained at 180° C. (356° Fahr.); the temperature being taken by two thermometers inserted in the oven through holes drilled in the door—one at a quarter of the distance between the burner teats and the top of the oven from the top of the oven, and the other at a quarter of the same distance from the burner teats—the bulbs of the two thermometers being equidistant from the two sides and from the back and front of the oven. The position of the thermometers is important, because very few ovens are uniformly heated. The drip tin is placed in position at the base of the oven, and the browning tin in its highest position. The tap is adjusted at intervals until the temperature of the oven is constant. The consumption is then taken over at least an hour's run, during which hour the average temperature and pressure of the gas and the barometric height are taken, and the calorific value of the gas is determined. Care is taken that the oven is tested away from strong draughts.

If the results obtained by this method are given as so many calories per cubic foot of oven space to maintain, they are far from comparable. For example, two ovens, although they are built on the same principle, and should have, therefore, approximately the same efficiency, give the following results:

Table I.

	Capacity	Cons. to Maintain (N.T.P.)	Cons. per Cubic Foot (N.T.P.)	Calories to Maintain.	Calories per Cubic Foot.
Oven A . . .	3·12	9·15	2·94	1243	399
Oven B . . .	39·87	51·33	1·29	6920	175

Now, consider an oven which would lose the maximum amount of heat from its surface. The external area of such an oven would be equal to its internal area, and the temperature of the two surfaces would be the same. If we can calculate the amount of heat lost from such an oven—which is, of course, the amount of heat required to maintain it at a given temperature—and then divide this quantity into the difference between this and the amount of heat found experimentally, we shall arrive at a figure which may be called the "percentage saving," and such a figure would be comparable for all ovens.

Heat is lost from the external surface by radiation, due to the surface being at a higher temperature than surrounding objects, and by convection, due to the passage over the surface of air at a lower temperature than the surface.

Let L_r = heat lost by radiation (in calories per square foot per hour).

Then $L_r = a\ (T_s^4 - T_a^4)\ 10^{-8}$.

where a is a constant. T_s is the temperature of the surface (in degrees absolute). T_a is the temperature of the external air (in degrees absolute).

Let L_a = heat lost by convection (in calories per square foot per hour).

Then $L_a = b(T_s - T_a)^{1\cdot23}$

where b is a constant.

Therefore the total heat lost

$$L_{a+r} = a\ (T_s^4 - T_a^4)\ 10^{-8} + b\ (T_s - T_a)^{1\cdot23}$$

For wrought iron $a = 0{\cdot}257$

For test room conditions $b = 0{\cdot}28$

If $T_s = 453°$ abs. (= 180° C.)

$T_a = 288°$ abs. (= 15° C.)

$$L_{a+r} = 0{\cdot}257\ (453^4 - 288^4)\ 10^{-8} + 0{\cdot}28\ (453 - 288)^{1\cdot23} = 239{\cdot}5 \text{ cals.}$$

For the given conditions, therefore, this is a constant for all ovens, and the total heat loss = 239·5 × A cals.

where A is the internal area of the oven.

Let heat used = H cals.

Then heat saved = 239·5 A − H cals.

$$\text{Saving} = \frac{239{\cdot}5\ A - H}{239{\cdot}5\ A} \times 100 \text{ per cent.}$$

Calculating the ovens A and B (Table I.) on this basis, we get:

Oven A.

Dimensions: 2 ft. 3½ in. high by 1 ft. 2½ in. wide by 1 ft. 1¾ in. deep.

Internal area (excluding base) = 2(2·292 × 1·188) + 2(2·292 × 1·146) + (1·188 × 1·146) . . . . = 12·06 square feet
Total heat loss = 239·5 × 12·06 . . . . . = 2,888 calories
Heat used . . . . . = 1,243 ,,
Heat saved . . . . . = 1,645 ,,

$$\text{Saving} = \frac{1645}{2888} = 56{\cdot}9 \text{ per cent.}$$

Oven B.

Dimensions: 4 ft. 10 in. high by 3 ft. wide by 2 ft. 9 in. deep.

Internal area (excluding base) = 2(4·833 × 3·0) + 2(4·833 × 2·75) + (3·0 × 2·75) . . . . . = 63·84 square feet
Total heat loss = 239·5 × 63·84 . . . . . = 15,290 calories
Heat used . . . . . = 6,920 ,,
Heat saved. . . . . = 8,370 ,,

$$\text{Saving} = \frac{8,370}{15,290} = 54{\cdot}7 \text{ per cent.}$$

By this method, then, two ovens built on similar principles, but differing in size, show approximately the same efficiency.

Improvements have been made in oven A; and the extent of the improvement is clearly shown by calculating the results on the basis of heat saved.

A_1 (first improvement)—
Heat used = 1104 calories
Heat saved = 1782 ,,

$$\text{Saving} = \frac{1782}{2886} = 61{\cdot}7 \text{ per cent.}$$

A_2 (final improvement)—
Heat used = 886 calories
Heat saved = 2002 ,,

$$\text{Saving} = \frac{2002}{2888} = 69{\cdot}3 \text{ per cent.}$$

The value of the constant (239·5) by which the internal area is multiplied to get the total heat loss, depends upon the temperature of the air, but is not proportional to the difference between the temperature of the oven and the temperature of the air.

The following table gives the value of the constant for different oven and air temperatures. By maintaining the oven at the corresponding temperature to a given air temperature, the constant 239·5 can always be used without appreciable error.

Table II.

Air Temperature. →	9° C.	10° C.	11° C.	12° C.	13° C.	14° C.	15° C.	16° C.	17° C.	18° C.
Oven Temperature.										
176°	**239·3**	237·9	236 6	235·3	234·0	232·6	231·3	229·9	228·8	227·2
177°	241·5	**240·0**	**238 7**	237·4	236·0	234 6	233 3	232·0	230·6	229·3
178°	243·5	242·2	240 8	**239·4**	238·1	236·7	235·4	234·1	232·7	231·3
179°	245·5	244·2	242 8	241·4	**240·1**	**238·7**	237 4	236·0	234 7	233·3
180°	247·6	246·3	244·9	243·6	242·2	240·8	**239·5**	238·1	236·8	235·4
181°	249·7	248·4	247·0	245·7	244·4	242·9	241·6	**240·2**	**238·9**	237·5
182°	251·8	250·4	249·1	247·7	246·4	245·0	243·6	242·2	240·9	**239·6**

Manufacturers have often tried to solve the problem of what is the maximum efficiency of a perfect oven. By the foregoing method, a solution can be obtained. Obviously, the efficiency is less than 100 per cent., for to obtain such a result no heat must be lost through the sides of the oven—in other words, the temperature of the oven would have to be maintained with no gas being burned.

To find a maximum figure,

let l^3 = volume of oven

then l = equivalent length of side

let t = thickness of lagging of oven (in feet)

T_1 = temperature of internal surface (in degrees absolute)

T_2 = temperature of external surface (in degrees absolute)

T_a = temperature of air (in degrees absolute)

K = conductivity of lagging material (in calories per square foot per 1 inch thickness, per 1° C. difference per hour)

then area of internal surface (excluding base) $= 5l^2$

area of external surface (excluding base) $= 5\,(l + 2t)^2$.

Heat lost by conduction from internal surface to external surface $= \frac{K}{12t}(T_1 - T_2) \times$ area calories per hour.

But this is equal to the heat lost by radiation and convection from the external surface.

That is,

$$\frac{K}{12t}(T_1 - T_2) \times \text{area} = [a(T_2^4 - T_a^4)\,10^{-8} + b\,(T_2 - T_a)^{1.23}] \times \text{area}.$$

If $T_1 = 453°$ abs. (= 180° C.)

$T_a = 288°$ abs. (= 15° C.)

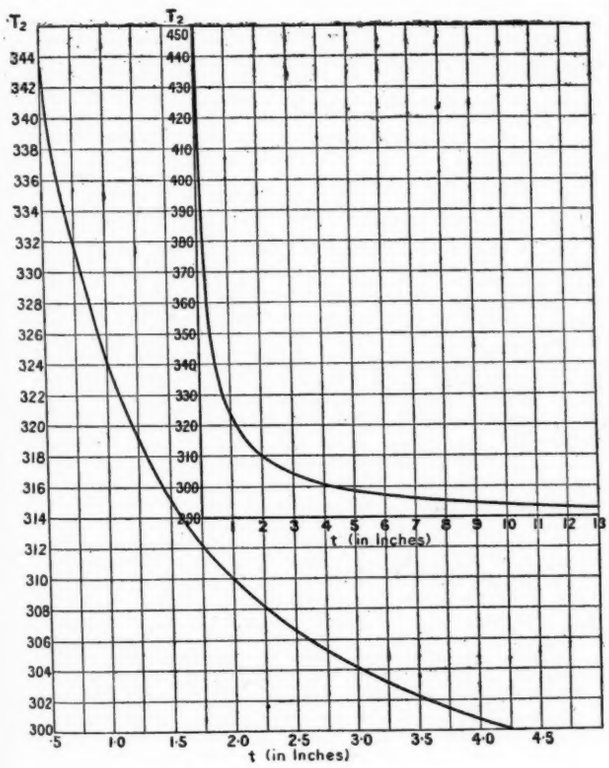
and K = 0·26 (conductivity of slag wool)

Then

$$\frac{0{\cdot}26}{12t}(453 - T_2) \times \text{area} = [0{\cdot}257\,(T_2^4 - 288^4)\,10^{-8} + 0{\cdot}28\,(T_2 - 288)^{1.23}] \times \text{area}$$

$$i.e.,\ \frac{0{\cdot}26}{12}(453 - T_2) = [0{\cdot}257\,(T_2^4 - 288^4)\,10^{-8} + 0{\cdot}28\,(T_2 - 288)^{1.23}] \times t.$$

By plotting t against T_2 the following curve is obtained:



By choosing any value of t and substituting the corresponding value of T_2 in the expression

$$\frac{K}{12t}(T_1 - T_2)\,5\,(l + 2t)^2$$

we obtain the minimum heat loss for this particular thickness of lagging material.

For example, if t = 1 inch

$T_2 = 324°$ abs.

Minimum heat loss in oven A (substituting $\sqrt[3]{v}$ for l)

$$= \frac{0{\cdot}26}{1}(453 - 324)\,5\,(1{\cdot}46 + 0{\cdot}17)^2 = 446 \text{ calories}$$

Heat saved = 2442 ,,

$$\text{Saving} = \frac{2442}{2888} = 84{\cdot}6 \text{ per cent.}$$

Minimum heat loss in oven B (substituting $\sqrt[3]{v}$ for l)

$$= \frac{0{\cdot}26}{1}(453 - 324)\,5\,(3{\cdot}42 + 0{\cdot}17)^2 = 2{,}162 \text{ calories}$$

Heat saved = 13,128 ,,

$$\text{Saving} = \frac{13{,}128}{15{,}290} = 85{\cdot}9 \text{ per cent.}$$

Flue Heat.

In the foregoing calculations, no account has been taken of heat lost through the flue outlet. In the figure for maximum heat loss (239·5 calories per square foot per hour) there is no need to include flue loss, for the figure is relative for all ovens. If flue loss were included, the figure would be affected in a definite proportion, and the results obtained for each oven, though differing in themselves, would be proportionately the same. The results of experiment, from which the saving efficiency is calculated, include flue loss; so that any improvement made in the oven is indicated, whether such improvement be a result of increasing the efficiency of the insulation of the oven or of decreasing the amount of heat lost up the flue. A certain amount of heat, however, must always pass through the flue, so the figures obtained for theoretical maximum efficiency are higher than those which could be reached in practice. To find the practical maximum efficiency, therefore, the number of calories lost up the flue must be added to the number lost by conduction through the sides of the oven.

It has been found by experiment that, in order to prevent the flames from "smothering" when the oven is burning its maximum amount of gas, it is necessary to allow about 6 cubic feet of air for each cubic foot of gas burned to pass through the oven, when the temperature of the oven is 180° C. As the oven is kept at this temperature, the same total quantity of air passes through the oven when the gas is turned low. The heat carried away by this volume of air must, therefore, be allowed for.

Oven A burns about 33 cubic feet of gas per hour at full consumption. Therefore, at 180° C. about 200 cubic feet of air pass through the oven. To raise 200 cubic feet of air per hour 165° C. requires 0·0087 × 200 × 165 calories = 287 calories; 0·0087 being the specific heat of air per cubic foot per degree Centigrade. The minimum heat used, therefore, with 1-inch lagging is 287 + 446 = 733 calories per hour.

$$\text{Maximum saving} = \frac{2155}{2888} = 74{\cdot}6 \text{ per cent.}$$

Oven B burns about 100 cubic feet of gas per hour at full consumption. Therefore, at 180° C., about 600 cubic feet of air pass through the oven. To raise 600 cubic feet of air per hour 165° C. requires 0·0087 × 600 × 165 = 861 calories. The minimum heat used, therefore, with 1-inch lagging, is 861 + 2162 = 3023 calories per hour.

$$\text{Maximum saving} = \frac{12{,}267}{15{,}290} = 80{\cdot}2 \text{ per cent.}$$

It should be noted that, for practical reasons, it is not necessary to burn as much gas initially in the larger oven as in the smaller one in proportion to their surfaces. If as much gas proportionally were burned in B as in A, about 1000 cubic feet of air would pass through B, and the maximum saving would be 76·5 per cent.

But this maximum could be surpassed by means of a damper arrangement in the flue, so that the less gas being burned the less air is taken through the oven. The amount of heat lost up the flue would then be a definite proportion of the gas burned.

The minimum amount of air required is, of course, the amount necessary for the complete combustion of the gas. Gas requiring 106 volumes of oxygen for combustion, and yielding 52 volumes of carbon dioxide and 122 volumes of steam per 100 volumes gives products of combustion consisting of 0·52 cubic foot of CO_2, 1·22 cubic feet of H_2O, and 4 cubic feet of N_2 approximately per cubic foot of gas burned. The amount of heat carried away in these products (assuming them to be at 180° C.) is:

N_2 . . .	4·0 × 8·59 × 165 =	5 67 calories
CO_2 . . .	0·52 × 12·07 × 165 =	1·04 ,,
H_2O . .	1·22 × 10·87 × 80 =	1·06 ,,
Total . . .		7·77 ,,

If the net calorific value of the gas is 141·0 calories per cubic foot, the percentage of heat lost up the flue is

$$\frac{7{\cdot}77}{141{\cdot}0} \times 100 = 5{\cdot}5 \text{ per cent.}$$

In oven A, therefore, the minimum heat loss

$$= \frac{446 \times 100}{94{\cdot}5} = 472 \text{ calories.}$$

$$\text{Maximum saving} = \frac{2416}{2888} = 83{\cdot}6 \text{ per cent.}$$

And in oven B, the minimum heat loss

$$= \frac{2168 \times 100}{94{\cdot}5} = 2289 \text{ calories.}$$

$$\text{Maximum saving} = \frac{13{,}001}{15{,}290} = 85{\cdot}0 \text{ per cent.}$$

The results for two ovens have been given in each case in order to show that this method of testing ovens is applicable to ovens of differing sizes. Although the maintaining test is perhaps the most important to which an oven is submitted, other tests should be applied before any particular make of oven is adopted. Just

as there are other factors besides radiant efficiency which should be taken into account in choosing a gas-fire, so in choosing a gas-heated cooker, equality of distribution of heat in the oven, the rate at which it reaches the required temperature, and other factors, in addition to the efficiency of the hot-plate burners, should all be considered.

THERMAL PROBLEMS FOR GAS ENGINEERS.

II.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

The Effects of Temperature and Pressure.

The effects upon solids and liquids of such variations of temperature and pressure as are comprised within ordinary atmospheric conditions are so slight that, in connection with all common practical operations, they may be ignored. The expansion or contraction of metals for each degree Fahrenheit of rise or fall in temperature is less than one part in 10,000; and the corresponding change for liquids ranges from one part in 2000 downwards, calculated on the bulk at 32°. The rate of alteration in bulk varies with each substance, no two being alike, with the exception of a few cases of apparent coincidence.

With gases, however, we have quite a different state of affairs. Both temperature and pressure—even within the limits of a few degrees of the former and a few ounces per square inch of the latter—exercise by no means negligible effects; and one rate applies to all, irrespective of composition. Any gas will expand or contract in the ratio of one part in 491·4 for each degree rise or fall in temperature, or one part in 273 for each degree Centigrade, calculated on the bulk at 32° Fahr.; and gases, having a comparative low specific heat, bulk for bulk, very rapidly take up, or part with, heat to surrounding solid or liquid substances. All gases are perfectly elastic, and therefore the bulk varies inversely as the pressure. One cubic foot under an atmospheric pressure of 14·72 lbs. per square inch is reduced to half a cubic foot in bulk if the pressure is doubled by increasing to 29·44 lbs. per square inch. So that, in regard to statements in which the volumes of gases are concerned, the conditions as to temperature and pressure must be accurately specified; and, to avoid confusion, it is usual to calculate the bulk at fixed or standard conditions. This procedure is commonly known as "correction to standard conditions." In dealing with ordinary air or any other gas that has been freely exposed to water, a further complication is introduced by the effect of water vapour, which may be present to any extent up to the saturation limit, which varies according to both temperature and pressure, and, under ordinary conditions, exercises a considerable effect on the volume and weight of the gas.

Table I. illustrates the effect of variations of temperature, within ordinary climatic limits, on the bulk and weight both of dry and of saturated air. The actual quantity of water present in the atmosphere at any stated temperature will be something less than the saturation limit, as indicated in Nos. 3, 6, and 10. Gases that have had free contact with water by standing over that liquid in a gasholder for some time, or by passing through a washer or wet meter, are considered to be "saturated" and to contain the same quantity of water as air at the same temperature. Dry gas may conveniently be regarded as pure, and, when saturated, as diluted or adulterated with water vapour.

There is no marked distinction or line of demarcation between a vapour and a gas. The former expression simply applies to a gas when it is not very far removed from the conditions of temperature and pressure that will secure its condensation into the liquid form, or that may be partially so condensed under any conditions to which it is likely to be exposed. The vapour of water and other liquids is capable of existing to a limited extent, as such, at temperatures considerably lower than the condensation or boiling point. We see from Table I., No. 10, that water can exist in the form of vapour at freezing point (32° Fahr.) to the extent of 6·4 cubic feet in 1000 cubic feet of air. The proportions of water vapour there stated apply not only to air, but also to any gas that is not condensable within or near to the limits of the temperature and pressure named; and questions relating to weight can be dealt with by substituting the specific gravity of the gas in question, as compared with air = 1, for the weights of air. In Table I., water is regarded as a vapour for the reasons above stated; but the term is only a convenient means of expression, having no definite meaning. As a matter of fact, there is no such thing known as a "perfect" gas, or a "perfect" vapour. The properties of the two are always intermingled, and it is the predominance of either the one or the other that really determines the title.

The loss of bulk that follows the cooling of a pure, dry gas may be called temporary, because it will be completely recovered on returning to the original temperature. If 1 cubic foot of dry air at 72°, is reduced to 32°, the bulk is reduced to 0·942 cubic foot [Table I., No. 10]. If subsequently restored to 72°, it expands to the original volume of 1 cubic foot; and a gas may be subjected to any changes of temperature within the limits of decomposition or condensation without effecting the property of returning to the original bulk at the original temperature of 72°.

The same, however, does not hold good for a saturated gas, unless any water vapour that may be deposited in the liquid form is allowed to remain in contact with the gas, and not then at temperatures lower than the original. The proportion of water vapour that constitutes the saturation point increases with the temperature. In Table I., No. 10, it will be observed that at 32° the percentage of water vapour by volume is 0·0062, but that at 102° it is 0·0679—more than ten times as much. The position is not affected by variations above the original; but at lower temperatures there will be a loss, additional to that occurring in the case of dry gas, due to the reduction in the saturation point and the consequent deposition of the excess of water in the liquid form. If the liquid is allowed to drain off, there will be a permanent loss of volume that will not be recovered on returning to the original temperature.

One cubic foot of saturated air at 72° consists of [Table I., No. 10] 0·9732 cubic foot of air and 0·0268 cubic foot of water vapour. If the temperature is lowered to 32°, the air is reduced to $\frac{0{\cdot}9732}{1{\cdot}089} = 0{\cdot}8937$ cubic foot, and the water to $0{\cdot}0062 \times 0{\cdot}8937 = 0{\cdot}0055$ cubic foot. The total bulk is $0{\cdot}8937 + 0{\cdot}0055 = 0{\cdot}8992$, and the loss 0·108 cubic foot, of which 0·0795 is due to the air and 0·0213 to the water deposited in the liquid form. Assume that after draining off the liquid the air is restored to the original temperature of 72°. The air will resume the original volume of 0·9732; but as about 80 per cent. of the water vapour has been lost by condensation, only about 0·0054 cubic foot will remain, and there will be a permanent loss of about 2 per cent. on the original bulk.

Table I.—*Weight and Bulk of Dry and Saturated Air at 29·92″.*

	Temperature, Fahr.	32°	42°	52°	62°	72°	82°	92°	102°
1.	Bulk of 1 lb. dry air, cubic feet	12·39	12·63	12·89	13·14	13·39	13·65	13·90	14·14
2.	,, ,, saturated air ,,	12·42	12·68	12·95	13·23	13·53	13·83	14·14	14·51
3.	,, consisting of cubic feet air	12·33	12·56	12·78	12·98	13·17	13·32	13·43	13·52
	,, foot water	·09	·12	·17	·25	·36	·51	·71	·99
4.	,, of 1 lb. water vapour	20·6	20·2	20·5	20·9	22	22	22·2	22·6
5.	Weight of 1 cubic foot of air, dry, lb.	·0807	·0791	·0776	·0761	·0747	·0733	·0720	·0707
6.	,, ,, ,, ,, saturated, lb.	·0805	·07884	·07723	·07558	·07392	·07227	·07072	·06890
7.	,, consisting of lbs. air	·08020	·07840	·07660	·07470	·07270	·07060	·06840	·06590
	,, water	·00030	·00044	·00063	·00088	·00122	·00167	·00225	·00300
8.	Bulk of 1 volume of dry air	1·0000	1·0203	1·0406	1·0610	1·0814	1·1017	1·1221	1·1426
9.	,, ,, ,, saturated air	1·0000	1·0210	1·0423	1·0651	1·0890	1·1139	1·1397	1·1683
10.	,, consisting of air	·9938	·9911	·9871	·9816	·9732	·9632	·9500	·9321
	water	·0062	·0089	·0129	·0184	·0268	·0368	·0500	·0679

The generally accepted rule of one part in 492 for each degree Fahrenheit of variation in temperature is sufficiently accurate for dealing with small changes of temperature; but when differences of 30° or more are concerned, or large volumes of gas, the figures stated in Table I. are preferable. This especially applies to saturated gases.

The difference may be illustrated by the following examples: (A = one part in 492. B and C = the table numbers for dry and saturated gas respectively.)

I.—100,000 cubic feet of a gas at 92° Fahr. are reduced to 62° Fahr. What is the volume at the lower temperature?

Answers: A 93,902 cubic feet, B 94,555 cubic feet, C 94,454 cubic feet.

II.—100,000 cubic feet of a gas are raised from 42° Fahr. to 102° Fahr. What is the volume at the higher temperature?

Answers: A 11,219 cubic feet, B 11,199 cubic feet, C 11,442 cubic feet.

I have never met with any allowance in respect to permanent loss in calculations relating to unaccounted-for gas; but if the gas, in the course of distribution, is reduced near to freezing point, it is not a negligible consideration. A saturated gas at 62° Fahr. contains 0·184 part of water, or 0·00088 lb. per cubic foot. And every gallon of water pumped from the drip-boxes on a gas distribution system represents 209 cubic feet of vapour at 62°, which is a permanent loss on the bulk of the gas as measured at the station meter at 62°.

Take, as an example, some considerations as to the subsequent life of 1 million cubic feet of gas as measured at the station meter and corrected to standard conditions. It will comprise 981,600 cubic feet of gas, and 18,400 cubic feet of water vapour. Passing on to the gasholders, in summer weather it may be exposed to a temperature of 92°, and, if freely exposed to water, would take up 51,910 cubic feet of water vapour, while the gas would expand to 1,038,200 cubic feet, making a total of 1,090,110 cubic feet. If it

could be passed through the consumers' meters under such conditions, many more gas engineers than can now do so would be able to report the "unaccounted-for gas" as a *minus* quantity. But under working circumstances this never obtains. The water represents over 5 per cent. in the total bulk, which explains why the heat of the sun has such a marked effect in drawing up a holder that is nearly full. It represents some 238 gallons of water. Probably the gas, before reaching the consumers' meters, may be reduced to 42°. At this temperature it would shrink to 944,149 cubic feet and the water vapour to 8438 cubic feet—a loss of close upon 5 per cent., as compared with 4 per cent. as indicated by the usual data. The vapour would weigh about 418 lbs. —say, 42 gallons—so that more than one-half of the quantity present at 62° would be deposited as liquid and removed by the syphon pump. In cold weather, the gas may be exposed to 32° in the holder, in which case it would be reduced to 919,800 cubic feet, and the water to 5839 cubic feet. The total, therefore, would be 925,639 cubic feet, or a loss of 7½ per cent. as compared with 6 per cent. indicated by the usual rule.

If the gas in practice left the holder under anything approaching such variations of temperature, the effects as to condensation in the mains would be more marked than they are at present, especially in cold climates. But, probably, after a time the surface of the water inside the gasholder tank becomes coated with a film of oily matter; and we know that even a very thin film is sufficient to prevent evaporation. The chief factor, however, is that, in the large bulk of water as contained in the tank, we have a valuable temperature compensator that counteracts both on the extremes of summer heat and winter cold. The gas in the upper parts of the containing vessel may be subject to variations of temperature extending over 60° or more; but before it reaches the valve on the outlet main, it is reduced or raised to the temperature of the bulk of water in the tank.

A similar effect obtains in connection with pressure. An increase lowers the saturation limit, and to this extent causes condensation in the liquid form. If such condensation is removed or allowed to drain off, there is a corresponding permanent loss.

(To be continued.)

COMPOSITION OF CARBURETTED WATER-GAS TAR.

Mr. Herbert K. Brunkow, writing in "Electricity, Power, and Gas," describes some tests of carburetted water-gas tar, undertaken with a view of ascertaining its value for the purpose of extracting benzol compounds from gas. The tar was a bye-product from a gas averaging 570 B.Th.U. per cubic foot, and therefore generated at higher temperatures than the ordinary. The oil used was Californian crude, of specific gravity 18·8 Beaumé. The tar was pumped through a series of screens to a settling tank, and thence to a store-tank, from which the sample was taken. The specific gravity of the sample at 95° Fahr., was 1·026. On an attempted fractional distillation, much difficulty was encountered by reason of frothing and boiling over in the still, and the clogging of the condenser tube with naphthalene. Notwithstanding every possible precaution in heating, and the introduction of picric acid into the still for the purpose of dissolving and retaining the naphthalene, these troubles continued. Evidently the tar contained an extraordinary quantity of water and a very small proportion of oils capable of retaining the naphthalene.

The calcium carbide method* gave satisfactory results for the determination of water, but necessitated an elaborate apparatus. Another method was drying in a water-oven for 24 hours at a temperature of 212° Fahr.; but this was not adopted until it had been ascertained that no oil evaporating at or below this temperature was present. Distillation under a vacuum of 17 inches of mercury prevented the choking of the condenser, and also admitted of a lower operating temperature. The soluble oils were separated from the lampblack by the use of carbon disulphide and a soxhlet extraction apparatus. The thimble and the flask having been previously tared, the respective quantities of lampblack and of oils were ascertained by weighing. The naphthalene was determined by placing a known quantity of the sample, contained in a silica boat, in a combustion tube connected with a series of Drechsel's washing bottles, charged with standard picric acid solution, and a filter pump, by which a current of air was drawn through the system, and at the same time heat was gradually applied to the combustion tube, sufficient to drive off the whole of the naphthalene.

The results of the tests showed that the sample consisted of about 60 per cent. of water, 10 per cent. of lampblack, 26 per cent. of heavy oil dried at 212° Fahr., that solidified on cooling, and 4¼ per cent. of naphthalene. The water seemed to be mixed with the other ingredients in the form of an emulsion; and the sample was apparently fairly saturated with naphthalene, as, when slightly cooled in a container, it deposited crystals on the sides of the vessel. The only reason why the tar could be pumped or injected under a boiler, was the large quantity of water contained in it. As an absorbent of benzol or light oils, it was found to be absolutely worthless.

* See "Proceedings" of the Pacific Coast Gas Association, Vol. VIII., p. 458.

COAL TAR AND ITS DISTILLATION.

By H. Zollikofer,
Manager of the Gas-Works, St. Gall, Switzerland.

[**Abstract Translation of a Paper read at the Annual Meeting of the Swiss Association of Gas and Water Engineers.**]

The coal tar produced in Switzerland, amounting in 1913 to about 27,000 metric tons, has hitherto mostly been sold for export —the net export in 1913 being 56·7 per cent. of the total production. Of the exported tar, 78·5 per cent. went to Germany, and 21 per cent. to France. A few years ago, tar fetched in Switzerland only about 16s. 3d. per ton; now it sells for more than double this price. Coal tar has a specific gravity between 1·10 and 1·26, and a calorific value of about 15,300 B.Th.U. per pound. The rise in value of coal tar which took place in the last few years before the war was due to the use of tar in road construction, and the employment of tar oils in Diesel engines and as fuel in the metal industry.

The composition of coal tar varies very greatly; but the following is given as a fair average: Benzene and homologues, 2·5 per cent., of which 1 to 1·5 per cent. is benzene and toluene, and 0·8 is xylene; phenol and homologues 2 per cent., of which 0·5 per cent. is phenol and 1 to 1·5 per cent. is cresol; naphthalene 6 per cent.; pyridine 0·25 per cent.; heavy oils 20 per cent.; anthracene 2 per cent.; asphalt 38 per cent.; water 4 per cent.; and gas, &c., 1·25 per cent. The light oil, middle oil, heavy oil, anthracene oil, and pitch which are obtained by the primary distillation of such tar have hitherto been obtained in Switzerland exclusively by importation; but there is no doubt that, except perhaps pitch, they could all be disposed of in the country if produced there. The pitch, however, amounts to at least 50 per cent. of the tar. According to Lunge, it is due to failure to make use of the bulky products of tar, such as the heavy oil and pitch, to the same advantage as the light oil and anthracene, that gas-works frequently have to burn their tar, even in Germany and Switzerland where the coal-tar colour industry has achieved its greatest triumphs.

Continuous Tar-Stills.

The older type of tar-stills, holding 15 to 20 tons of tar, and heated direct by coal, gas, or oil, is described, with the mode of operating them. The dangers and inconveniences of these intermittent stills led to the introduction of continuous stills, of which the systems of Hirzel, Sadewasser, Kubierschky and Borrmann, and Raschig are named as the most modern. Hirzel's system has been in use for over two years at a roofing-felt works at Düsseldorf. Sadewasser's system is in operation at the works of Julius Pintsch at Fürstenwalde, and at the Wandsbeck works of the Hamburg gas undertaking. Dr. Raschig's process, of which less is known, has been in use for four years under his own supervision at Ludwigshafen. All these plants are open to inspection, which is not the case with the Kubierschky and Borrmann plant at a chemical-works at Essen.

Hirzel's process employs two or three small direct-heated stills, over the hot bottoms of which the tar flows in a thin layer. Gas liquor and light oil are separated in the first still at the lowest temperature; middle oil (or heavy tar for road use) is prepared in the second still; heavy oil is recovered from the third still, from which soft pitch runs off continuously. The distillation is promoted by the use of superheated steam.

In Sadewasser's process the tar is highly heated in a direct-heated tubular superheater, from which it is forced through a spraying nozzle into a vacuum vessel which it enters in a finely-atomized state, so that the particles of tar are forthwith volatilized. Liquid pitch is first drawn off, and then, on cooling, the crude heavy and middle oils, followed by the light oil and the gas liquor.

In the process of Kubierschky and Borrmann the tar flows continuously in finely-divided jets down a column against a counter-current of superheated steam, in the presence of which the high-boiling oils evaporate at a comparatively low temperature. The composition of the vapours naturally depends on the ratio of the vapour tensions of water and the oils at any temperature. The Zürich gas undertaking has erected a plant on this system.

Dr. Raschig's process uses three stills, of which the first two are heated by steam and the third by superheated water; neither the steam nor superheated water coming into direct contact with the tar undergoing distillation. In the first still the gas liquor and the light oil are driven off under atmospheric pressure; while the second still, in which the middle oil is driven off, is under vacuum. The third still, which is also under vacuum, volatilizes the constituents which form the heavy oil; while liquid pitch runs off continuously from it.

Tar Distilling Plant at the St. Gall Gas-Works.

Plant on this system has been erected at the St. Gall Gas-Works. This plant comprises an overhead tar-storage tank, from which the tar for distillation flows through a preheater, in which it is heated to a temperature of about 100° C. by a counter-current of the hot pitch running off from the last still. From this preheater the tar passes to the first still, in which it is heated to 140° to 170° C.—according to the pressure of the steam employed for heating the still; and the ammoniacal liquor and light oil are

thereby expelled from it. The "freed" tar passes from this still into an equalizing column, into which dips the suction pipe by which the tar is drawn by the vacuum in the second still into the latter. Any change in the vacuum is automatically balanced by a change in the level of the tar in the column. The temperature in the second still is the same as in the first, depending on the pressure of the steam; but as the second still is under vacuum, all constituents of the tar boiling below 200° to 230° C. are evaporated in it. The hot tar passes from the second still to a second equalizing column, and thence to the third still, where it is heated, while under vacuum, to about 280° C. by water which is superheated to about 300° C. by flow and return through a superheating furnace. The superheated water is in a closed circuit, provided at the top with a pressure gauge and temperature recorder. The high temperature and high vacuum in the third still drive off from the tar all constituents boiling between 230° and 350° C., leaving in the still only a residue of pitch, of which the softening point can be altered by varying the temperature in the still. The hot pitch runs off from the still, through the counter-current preheater for the crude tar, into the pitch bed.

Should refined or prepared tar (such as is used in roofing-felt manufacture or in steel-works) be required instead of pitch, the third still is put out of action. The distillates from the vacuum stills are condensed in elevated worm condensers, from the outlet pipes of which the condensed liquids run off under a seal equal to the atmospheric pressure. When tar oil for power, heating, or impregnating purposes is required, the distillates from both the vacuum stills are run into a single receiver. There is scarcely any deposition of naphthalene and anthracene from this mixed oil, which has a calorific power not less than 15,930 B.Th.U. per pound. No attempt has yet been made to use this oil for carburetting water-gas. On the other hand, the distillates from the two vacuum stills may be run into separate receivers if the middle oil and the heavy oil are required unmixed. The distillate from the first of the three stills after condensation passes into a separating chamber, from which the light oil is run off to a receiver, and the ammoniacal liquor is run off—from a lower level—to the works' liquor well.

At present, the plant at St. Gall is operated to yield only gas liquor, light oil, tar oil, and pitch, or gas liquor, light oil and distilled or refined tar; but if later there is a remunerative demand in Switzerland for middle oil, or carbolic oil and naphthalene, and heavy oil, the plant will be operated accordingly. The products obtained up to the present are: (1) Light oil, specific gravity ·9070 to ·9093, having a calorific power of 16,807 B.Th.U. per pound, and containing 35·1 to 47·5 per cent. of first runnings and benzol, 10 to 11 per cent. of toluol, 8·5 to 10·5 per cent. of xylol, and 6·1 to 12·5 per cent. of cumol, &c.; (2) mixed tar oil, specific gravity 1·040, flash point, close test 79° C., open test 92° C., and having a calorific value of 15,943 B.Th.U. per pound; (3) hard pitch, specific gravity 1·284, softening point 76° to 78° C., and melting point 81° to 84° C.; and, as an alternative to tar oil and pitch, (4) heavy tar, specific gravity 1·230, flash point, close test 143° C., open test 260° C., and containing 91·8 per cent. of carbon (free and combined).

In 1913, the Swiss gas-works produced 327,868 metric tons of coke; while 428,000 metric tons were imported. Of the imported coke, 85·5 per cent. came from Germany and 13·3 per cent. from France. For the imported coke £695,172 was paid in 1913; and if the output of the gas-works were stopped, owing (say) to gas being displaced by electricity, it would be necessary to send abroad the further sum of £532,000 for coke to take the place of that now produced in Swiss gas-works. Nearly four milliards of B.o.T.U. of electricity would be required to give the same heating value as the gas, coke, and tar obtained from the Swiss gas-works.

Tar Distilling Plant at the Zürich Gas-Works.

The discussion on M. Zollikofer's paper was opened by M. Escher, the Manager of the Zürich Gas-Works, who stated that, for the same reasons as prevailed at St. Gall, it had been decided recently to instal tar-distilling plant at the Zürich Gas-Works; but, after inspecting practically the same installations abroad, it had been thought best to adopt plant on Kubierschky's system. Incidentally, it might be mentioned that there was an installation on the Sadewasser system in Switzerland—viz., at Chiasso, where the tar from the gas-works in the Canton of Tessin was worked up. Unlike many systems which fractionally distil the tar, Kubierschky's distils it at once and fractionally condenses it. It has the advantage that there is less commingling of the several fractions. In the Zürich plant the tar is highly superheated in a preheater before it enters the rectifying plant, which is a counterpart of the ordinary liquor distilling plant. In this rectifying plant the volatile constituents are driven off from the tar by superheated steam, the temperature of which is fixed according to the grade of pitch required. By regulation of the temperature of the steam it is easy to produce either hard, medium, or soft pitch or refined tar. The tar passes downwards through the apparatus; the volatile constituents passing upwards with the superheated steam into the condenser. By regulating the temperature of the condenser, either anthracene oil only can be obtained in it and the heavy oil allowed to pass forward, or the heavy tar oil can be condensed along with the anthracene oil. From the vapours passing forward, the middle oil is deposited in the next condenser. This is followed by a fractionating column condenser, which separates the light condensate into a light oil and a moderately light crude benzol. Thus the condensed tar vapours are collected in four different receivers; and it would be quite feasible at any time to introduce another condenser in the train of condensing plant.

In order to economize heat, only the last two condensers use water as the cooling medium, and the crude tar is employed instead in the first two condensers. By means of a bye-pass, more or less of the tar is passed through the first condensing column in order to provide the desired temperature according as anthracene oil or the anthracene oil-heavy oil mixture is required. The steam, which has to be superheated to 400° C. in order to produce hard pitch, is taken from the ordinary boiler plant and passed through a superheater which is heated by a pitch burner. The waste heat is utilized in the tar preheater, the gases leaving which have a temperature of only 150° to 160° C. It is characteristic of the fractional condensation plant that there is no great pressure throughout the apparatus; about one-fifth of an atmosphere above normal sufficing to completely overcome any resistance in the plant. The products obtained in the Zürich plant correspond in some measure to those produced at St. Gall. The crude benzol, however, can be used forthwith as a motor spirit. The pitch is obtained in the liquid state, and, as it is not always easy to secure a good market for it, the question of its use as fuel has been studied. The superheater is not provided with a coke fire but with a liquid-fuel burner originally intended for the consumption of tar oil. Since, however, tar oil has fetched a good price, crude tar has been used instead, and lately hard pitch. In using the latter, it is necessary that the compressed air used for atomizing the fuel should be at a temperature higher than the melting point of the pitch. Molten pitch is as fluid as tar at the temperatures at which it is ordinarily employed for heating purposes. There is no insuperable difficulty in industrial work in using pitch for fuel in the same way that tar is now actually used in metallurgical furnaces. This is a matter of great importance in regard to fuel supply in Switzerland.

The Bordeaux Judgment.

The "Journal des Usines à Gaz" reports the signature by the President of the French Republic of the order authorizing the agreement arrived at between the Municipality of Bordeaux and the Bordeaux Gas Company and sanctioning the new scale of charges, up to 38 c., in force since May 10 last. The order is thus the official recognition of the principle laid down by the Conseil d'Etat according to which the Municipality are called upon to bear a part of the additional charges on the gas undertaking due to the rise in the price of coal, notwithstanding the explicit terms of the contract. Our contemporary remarks: "There is, therefore, nothing to deter other firms from following the example of Bordeaux, and taking steps to amend conditions which are inequitable and without relation to the actual circumstances. The fairness of the decisions of the Conseil d'Etat and of the President will not be questioned, since it will be admitted that the community should pay its share in relief of a situation which forms part of the country's struggle for victory.

Decreased Number of Boiler Explosions.

It is pleasing to be able to record that during the twelve months ended June 30 last year there was, according to the report to the Secretary of the Board of Trade upon the working of the Acts relating thereto, a falling off in the number of boiler explosions which occurred; and it is to be hoped that the statistics for the year just completed, when they come to be issued, will reflect a continuance of this improved condition of affairs. It appears that the number of explosions in the period to June, 1915, was 61, which compares with an average of just over 72 for the 33 years since the Act of 1882 came into force. The number of persons killed and injured, also, were fortunately below the averages. In three cases during the year there were formal investigations with regard to explosions; and the causes were clearly ascertained. Particular attention is drawn in the report to the findings of the Commissioners in one of these instances—the user of the boiler, an insurance company, and one of their inspectors being held to blame. Towards the cost of the investigation the user was ordered to pay £15, the insurance company £80, the inspector £5. As an outcome of this case, the Commissioners made an important practical recommendation, which was to the effect that insurance companies should arrange as far as possible to vary the districts assigned to their inspectors, and that there should be more careful supervision in the passing of inspectors' reports, and in the issue upon the reports of certificates of fitness for a given working pressure. Deterioration or corrosion was the most frequent cause of explosions; next coming defective design or undue working pressure.

American Sulphuric Acid Output and Exports.—The total sulphuric acid production of the United States in 1915 was 3,868,152 tons of 50° acid, worth about £6,000,000 sterling, and 189,795 tons of concentrated acid worth £560,000, or a total of 4,057,947 tons. Zinc and copper smelters produced more than 25 per cent. of the output. The 1914 output was 3,762,417 tons of 50° acid. The exports of 34,737 tons in 1915 exceeded all previous records—comparing with only 5882 tons in 1914 and 4325 tons in 1913. In January the exports were 3691 tons, falling to 1426 tons in February.

RESINOUS WOODS AS GAS-MAKING MATERIALS.

Some month or two ago, as was mentioned in the "JOURNAL," requests were made to the French Professional Gas Syndicate for information as to the practicability of employing resinous wood in whole or part replacement of coal for the production of gas. A Committee of the Société Technique published in the "Journal des Usines à Gaz" for June 20 a report on the matter, of which the following is a translation.

In some parts of Switzerland and Bavaria gas obtained by the distillation of wood has been employed under the name of "Pettenkofer gas." [Wurtz's "Dictionary of Chemistry" has given particulars of this.] The distillation was carried out in cast-iron retorts; a charge of 50 kilos of dry fir yielding in 1½ hours 20 cubic metres of gas, 20 per cent. of very compact "coke," and from 5 to 7 per cent. of tar. The gas contained about 25 per cent. of carbon dioxide, the removal of which (though a simple matter chemically) called for large and costly plant. Thus purified, the gas was found to consist of 18·5 per cent. of hydrogen, 62 per cent. of carbon monoxide, 9·5 per cent. of methane, with 7·7 per cent. of other hydrocarbons. Suppliers of the gas claimed that its illuminating power was at least equal to that of coal gas—a claim which may be questioned, in view of its composition. But at any rate, the gas, owing to its density, required the use of a wide-slit burner.

Examination of Riché gas showed that wood could yield a gas which was deserving of notice as a fuel for gas-engines. As regards the removal of carbon dioxide, it may be taken that 1 kilo of lime is required per cubic metre of gas.

Some works, in Algeria particularly, have made use of white eucalyptus of ·945 specific gravity (the red wood is only ·585) in admixture with coal to the extent of about 20 per cent. The wood is sawn up into pieces not over 10 cm. in thickness, and is distilled for two hours at a relatively low temperature. The wood charcoal is fairly compact. If the wood be in larger pieces, a longer time of distillation is necessary, and the charcoal is then powdery and unsaleable. The charcoal amounts to 24 per cent. of the wood—more than 2·5 per cent. of it being dust. The yield of gas is about 330 cubic metres, of poor illuminating power. It is necessary to charge the retorts smartly; also to quench the "coke" quickly (with water), in order to avoid loss and not to spoil its appearance.

In Russia, one large works during the present war has found it necessary to modify its regular practice by distilling coal and wood together, and has obtained results as follows: With a mixture of 35 per cent. of coal, 64 per cent. of wood, and 1 per cent. of mazout (petroleum residue), the percentage yield was 31·82 per cent. of gas, 60 per cent. of coke, and 15 per cent. of wood charcoal. A mixture of 21 per cent. of coal, 78 per cent. of wood, and 1 per cent. mazout (petroleum residue), produced 33·2 per cent. of gas, 60 per cent. of coke, and 15 per cent. of wood charcoal.

The mixture of coke and charcoal is hardly suitable for heating furnaces; it is necessary to increase the proportion of coke. The temperature of distillation, however, does not need to be so high as for the distillation of coal alone. Purification is done first with oxide of iron and then with lime. The object of the mazout is to increase the illuminating power. The density of the gas is greater, necessitating some alteration in plant—*e.g.*, for increase of supply pressure.

Among resinous woods, two trials were made of Anjou pines, in 6-metre retorts: Loss in weight on previous drying, 35 per cent. With a charge of 590 kilos in fifteen pieces, distributed in three retorts, the time of distillation was three hours, the percentage of wood charcoal, 18·6. The gaseous mixture, although produced on a large scale, has not been studied as regards quality or quantity; but as the latter remained constant, it was assumed that, as regards quantity of gas, the coal could be replaced by wood, weight for weight. In a second trial, 537 kilos of wood yielded 12·6 per cent. of wood charcoal.

With resinous "Pine des Landes," 3156 kilos, in pieces one metre long, were distilled in nine retorts of 3-metre length for three hours. The yield of gas was 796 cubic metres (about 25 per cent.) of somewhat low illuminating power, although about 50 per cent. of the logs were impregnated with resin. The wood charcoal amounted to 23 per cent., of which, upon sifting, one-third was found to be dust.

Another material is the resinous refuse, consisting of the vegetable *débris* left in the filters through which crude resin passes in the production of essence of turpentine. Its very rapid distillation leaves no residue to speak of; while it yields 65 per cent. of a very luminous gas. Unfortunately, the cost of the product (more than 160 frs. per tonne) is prohibitive, and the supply very limited.

Residues from olives have been employed by some southern works, with results as follows: Olive pulp (residue left in extracting the oil and containing no kernels) distils very rapidly, and yields a gas of great illuminating power. Treated in seven retorts, each 3 metres in length, 560 kilos was completely distilled in two hours at a bright-red heat. It yielded 41 per cent. of gas of average illuminating power (Giroud) 73·5 litres. The retorts contained 28 per cent. of dust, of ·33 specific gravity, which, when mixed with tar, was used in firing boilers.

A mixture of extracted pulp and broken or whole kernels had a specific gravity of ·67. On distillation, 1080 kilos. of it at a cherry red heat yielded 33·5 per cent. of gas in four hours. The illuminating power (Giroud) was 107 litres; and the residue in the retort, amounting to 24 per cent. of the charge, formed an excellent fuel for raising steam, when mixed with 20 per cent. of tar, as it did not give rise to clinker.

The general recommendation of the Committee is that none of the materials provide a satisfactory substitute for coal. The various woods and refuse which have come under their notice are of only local utility. While they may be of some value in circumstances of exceptional difficulty, their more general use would lead to an increase of their price such that they would be less economical than coal. Moreover, the distillation of wood and of other bodies containing cellulose produces organic acids—in particular, acetic acid, the action of which on the plates of the hydraulic main is considerable. Where wood and coal are distilled together, this injurious effect has not been experienced, no doubt as the result of the neutralization of the acid by the ammonia obtained from the coal. But the use of wood alone is certainly conducive to destructive action. Moreover, the density of wood gas being very high, a considerable proportion of it in admixture with that from coal would call for special adjustments of the appliances in which the gas is consumed.

In the following issue (that of July 5) the "Journal des Usines à Gaz" reported a further communication upon the subject from the Société Technique. It quotes the following data compiled from Knapp's "Traité de Chemie Technologique" and Vincent's "Traité sur la Carbonisation du Bois en Vases Clos:" The nature of the wood is practically without effect. One hundred kilos of wood yield, according to the species, from 33,450 to 39,800 cubic metres of gas. The greater the degree of moisture of the wood, the larger the proportion of carbon monoxide in the gas; hence it is well to dry the wood for twenty-four hours in chambers adjacent to the retort-bench. Retorts of the ordinary form were found to be the most suitable—distillation taking place rapidly (in about an hour and a half), while retorts of cast-iron were found best. A retort measuring 0·65 by 0·45 by 2·70 metres produced 250 to 300 cubic metres of gas per twenty-four hours, each charge representing about 75 kilos of wood.

The condensing arrangements require to represent a larger surface, and a greater degree of cooling, than for the distillation of coal; and therefore a water-jacketed condensing main is recommended.

As wood gas contains about 20 to 25 per cent. of its volume of carbon dioxide, it is necessary to purify with lime. This process is the chief drawback to the distillation of wood, since it calls for the use of 100 to 110 kilos. of slaked lime per 100 cubic metres of gas produced. Moreover, the purification is not complete—about 1 or 2 per cent. of carbon dioxide remaining in the gas.

According to Liebig, the illuminating power of wood gas compared with that of coal is 6:5. The density varies between ·6 and ·7; and at the normal pressure burners consume less and require less air for combustion. Flat-flame burners require a wide slit—about 0·9 mm.

The following particulars relate to experiments which have been carried out at different times in France: In 1863, M. Audouin, of the Paris Gas Company, made a series of tests at the Villette experimental works, employing a single retort of refractory material of the ordinary pattern used for coal, and at a temperature of from 850° to 900° C. He found it was necessary to use half a kilo of lime per cubic metre of gas for the removal of carbon dioxide. M. Audouin also found it difficult to remove the impurity.

Towards the end of 1870 other tests were carried out at the Villette works in attempts to make good the scarcity of coal caused by the siege of Paris. Wood, however, was found to be as scarce a material as coal, and the tests fell through. In 1894, the experiments were revived by M. Audouin, with the idea of ensuring a supply of wood charcoal necessary for the population of Paris in the event of a siege. In these tests, distillation was done at as low temperatures as 400° C. The gas obtained was non-luminous, but the wood yielded 25 per cent. of its weight of charcoal, weighing about 24 kilos per hectolitre. At higher temperatures the wood yielded only 14·5 per cent. of its weight of charcoal, averaging about 15 kilos per hectolitre, and approximating more closely to the small coke used by bakers. It weighed 11·5 kilos per hectolitre.

Alleged Dangers of "T. N. T."—It is officially announced that the attention of the Minister of Munitions has been drawn to the fact that persistent rumours (possibly of enemy origin) are in circulation as to the danger to the life of men and women employed at national filling factories. These rumours are most misleading, and are affecting the labour supply at the new factories. Dr. Legge and Dr. Collis, His Majesty's Medical Inspectors at factories under the Home Office, have authorized the issue of the following official contradiction of such rumours: "High explosives may cause skin irritation. This, however, is not a danger to life, and does not persist when the work is discontinued or changed. "T. N. T." is the explosive which may cause illness; but out of the many thousands coming into contact with it, the number seriously or fatally attacked has been limited to a few isolated cases. Strict observance of the precautions laid down, and use of the protective means provided at national filling factories, should ensure safety." It is pointed out that any person who spreads or repeats any rumour likely to prejudice the output of munitions may be held to be guilty of an offence under the Defence of the Realm Regulations.

COMPARISON OF MODERN COAL-GAS PLANTS.

By Vernon Baker, Chief Engineer to the Russell Engineering Company, of St. Louis, U.S.A.

[A Paper read before the Indiana Gas Association.]

From time to time, papers have been written telling of the progress made in the methods of coal-gas manufacture or on the state of the art of coal carbonization. It is not so far back when many builders were spending thought in trying to standardize certain types they had developed. It was the experience of all, however, that this idea, the purpose of which was economy of construction, was not to be realized. So many new factors were being brought into the problem, and so many improvements were suggested from various quarters, that instead of standardization there developed a rivalry among builders to see which could present the most novel and economical plant as to operation, instead of economy in construction only. Among the many factors affecting the changes in methods of carbonization were the growing scarcity of labour, the realization that the old methods were crude and susceptible of many improvements, and the discovery that with silica material many problems could be solved that were impossible of solution with fire-clay as a refractory material, the decrease in the price of gas to consumers, the rise in the price of coal, the increased cost of the materials entering into construction, and competition of electricity for light and power.

Selection of Type of Plant.

Of very recent years, the complaint of those asked to prepare papers on the subject of coal carbonization has been that there were so many new types in process of development or in the testing-out stage, which had not reached the point where figures were available for comparision, that any paper on the subject was necessarily incomplete and inconclusive, and, while interesting as giving food for thought, it was more or less unsatisfactory to writer and reader, in that very few actual figures were to be had. At this date, however, several examples of the newer types of plants have been in operation for a sufficient time to obtain figures which make a comparison feasible. During the writer's experience as a builder, his firm have been called upon frequently to give advice as to the type of plant suitable for certain particular works, and to make estimates of cost for same. Frequently, after an estimate for one type of carbonization plant was worked-up and the figures submitted, the company asking for the estimate changed their minds, and wanted additional figures on some other type. The work then had to be done all over again. The gas company had only a vague idea of what they wanted, until they saw some definite plans and figures. All this meant loss of time for the gas company in deciding what they needed, and considerable expense and loss of time and energy on the firm's part. They came to the conclusion that, owing to an absence of published tabulated information regarding gas plants, the gas companies and builders alike were more or less at sea when it devolved on them to recommend the kind of plant to build.

Therefore, early during 1915, the firm decided to secure as much data on the subject of coal carbonization as they could, and put this into shape to be used quickly—thus eliminating to a considerable extent much unnecessary preliminary work in deciding on the type of plant which should be installed at any particular works. As a first step, they tabulated figures indicating the number, type, and capacity of coal-gas plants built during the last few years, to show what was actually being done. This would be some indication of what kind of plants would probably be built during the next few years—in other words, show the trend of coal-gas bench construction. Table No. 1 gives the result of this tabulation, and includes some very recent plants contracted for, but not yet completed. It is, therefore, indicative of what the present demand in the coal-gas industry in the United States to-day is for. It must be borne in mind that in some cases a particular method of carbonization had already been established; and this fact was most likely to be the deciding factor when any extensions were to be made. The table will give an idea as to what many gas men have decided to be most suitable for their needs; other people's conditions may require something else.

Table 1.

Type and Capacity of Coal-Gas Plants Built During the Last Few Years.

Type of Apparatus.	Capacity of Plants per 24 Hours.	No. of Installations Counted.	Total Capacity per 24 Hrs.
	Cubic Feet.		Cubic Feet.
1.—Closed-end horizontal sixes, half or three-quarter depth . . .	50,000 to 300,000	27	2,450,000
2.—Through horizontal sixes, half or three-quarter depth, with hand-power pusher . . .	210,000 to 420,000	8	2,640,000
3.—Through horizontals with eight or more retorts 15 inches to 22 inches in length, operated with mechanical charging and discharging machines	500,000 to 4,000,000	18	30,850,000
4.—Inclines — with either slots or retorts . . .	300,000 to 1,000,000	11	4,900,000
5.—Verticals of various types	500,000 to 4,000,000	11	6,000,000

Comparison of Various Types.

The next step was to study carefully the data collected regarding these types, and make comparisons. The comparisons were to be in regard to: First, cost of installation; secondly, cost of operation; and, thirdly, net carbonizing cost per 1000 cubic feet of gas after deducting the returns from residuals.

In attempting to make the first comparison—*i.e.*, cost of installation—it was found that, though there were a multitude of figures, some of them did not apply to the present time; some were incomplete; others, because of their lack of sureness and uniformity, were unreliable. They therefore went to work and made actual drawings and actual up-to-date estimates of various types of plants, so that the comparisons would be on an equal basis. All this involved considerable labour in the engineering department. It was worth the cost, however, in that the firm can now give a preliminary estimate at short notice. It enables a gas man, after a little study of the accompanying charts, to eliminate certain types as unsuitable for his purpose, and to concentrate his study on one or two types.

On Chart 1 are plotted the relative costs of five types of coal carbonization plants. The curves are based on actual figures, and represent the installation costs, including benches, retort-house coal-handling machinery, coke-handling machinery, foundations, and, in fact, all the apparatus necessary for carbonizing the coal, from the time that the coal is run into the crusher to the

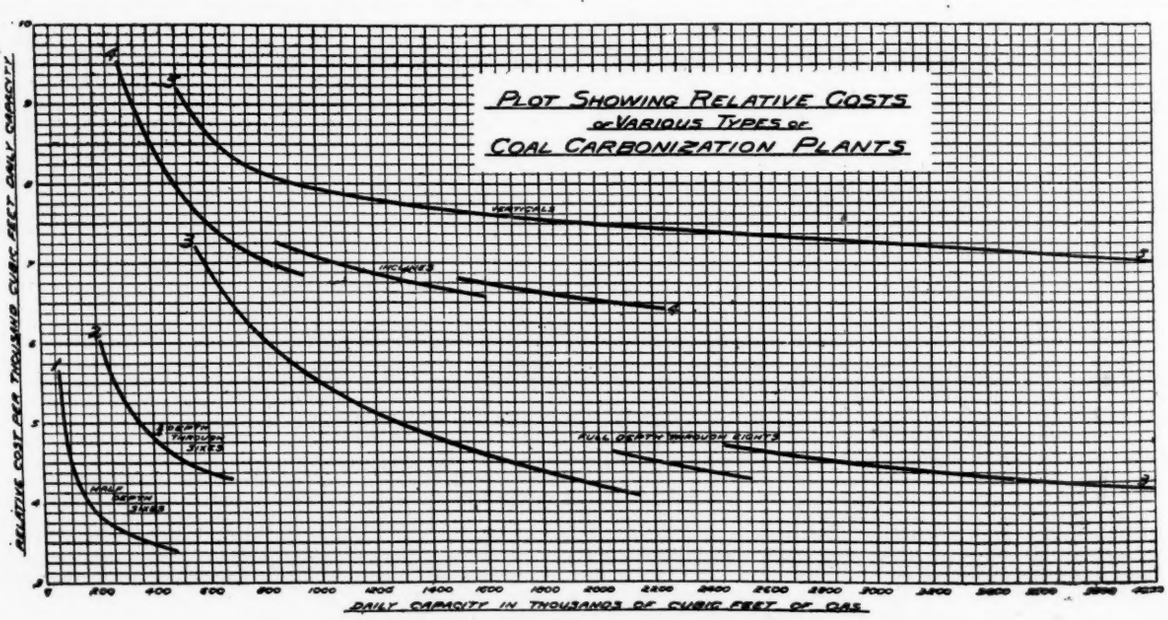

PLOT SHOWING RELATIVE COSTS
OF VARIOUS TYPES OF
COAL CARBONIZATION PLANTS
VERTICALS
INCLINES
FULL DEPTH THROUGH SIXES
FULL DEPTH THROUGH LIGHTS
HALF DEPTH SIXES
RELATIVE COST PER THOUSAND CUBIC FEET DAILY CAPACITY
DAILY CAPACITY IN THOUSANDS OF CUBIC FEET OF GAS

CHART. 1.—RELATION OF COST TO CAPACITY.

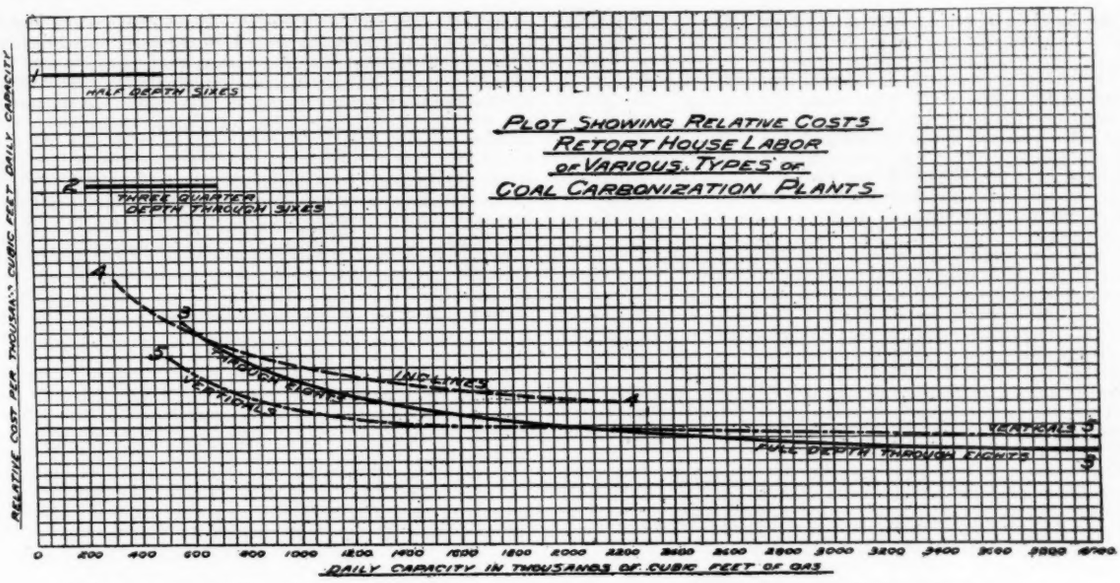

PLOT SHOWING RELATIVE COSTS
RETORT HOUSE LABOR
OF VARIOUS TYPES OF
COAL CARBONIZATION PLANTS
HALF DEPTH SIZES
THREE QUARTER DEPTH THROUGH SIZES
INCLINES
VERTICALS
FULL DEPTH THROUGH EIGHTS
RELATIVE COST PER THOUSAND CUBIC FEET DAILY CAPACITY
DAILY CAPACITY IN THOUSANDS OF CUBIC FEET OF GAS

CHART 2.—RELATIVE COSTS OF RETORT-HOUSE LABOUR OF VARIOUS TYPES OF CARBONIZATION PLANTS.

delivery of the coke at the end of the retort-house and the gas in the foul main at the retort-house walls. The benches of each type are of the most modern design, with silica retorts and settings, furnaces and recuperators of latest design, and of ample capacities. Superheated steam and primary air preheating arrangements are included in the design of the larger benches.

The estimates of cost do not include costs of any real estate, organization expenses, interest on money during course of construction, legal expenses, &c. In making and compiling the estimates, all plants were considered as being built for a central city as in Southern Michigan. The figures plotted, therefore, are only relative. On account of the varying freight rates to different points, and because of varying labour and material costs, and for other reasons, actual costs are not shown on the charts. The points above mentioned, however, have an equal bearing on each type of plant.

The second comparison is a consideration of the labour necessary to operate the various types of plants selected for consideration. This involved considerable discretion. The firm found, on studying the labour figures they had collected in the past years and the figures received recently from many plants in various parts of the country, that few places worked under the same conditions or were exactly comparable. They therefore endeavoured, as far as practicable, to reduce all figures to the same basis.

Chart No. 2 shows the relative cost of retort-house labour, including the total carbonization cost—*i.e.*, starting with the labour required to bring in the coal, and ending with taking out the coke. The only labour considered is that in the carbonization plant. No labour for purification of gas, or for supervision, &c., or overhead is included. All plants were considered as working two shifts per day; and the wages of labourers taken the same per day for all.

The third comparison is meant to show the actual net carbonization cost by deducting from the supply and labour cost the returns from the bye-products recovered. The figures used in this determination were taken from the published reports of plants, and from answers to personal letters to many gas makers using different types. In all cases averages were taken.

Chart No. 3 shows the relative net carbonization cost of making gas in all the five types. The figures used in plotting these curves were arrived at by deducting the value of the residuals from the sum of the items of outlay. The bye-products considered are coke, ammonia, and tar. The items of outlay comprise the cost of coal carbonized, retort-house labour, repairs to benches or upkeep, interest and depreciation, and the steam to operate the plants.

The difference between these two totals gives the actual manufacturing cost of the gas, considering the carbonization part of the plants only. The unit of value for coal, coke, tar, and ammonia is assumed the same for all the plants. The retort-house labour is taken from figures shown on Chart No. 2. It is assumed that the life of the plants will be twenty years; and interest and depreciation are taken at 5 per cent. each, or 10 per cent. on the figured costs shown on Chart No. 1. The coke recovered is that left over after deducting the bench fuel. The figures used in estimating the residuals were secured from a considerable number of plants of each type, and represent an average of what should be, and is being, done when the plant is operated efficiently.

Operation Details.

The curves are numbered from 1 to 5 on each chart. Curve No. 1 in each case represents horizontal benches of sixes with closed-end retorts; the furnaces and recuperators being either one-half or three-quarter depth. In this type, the coal is brought

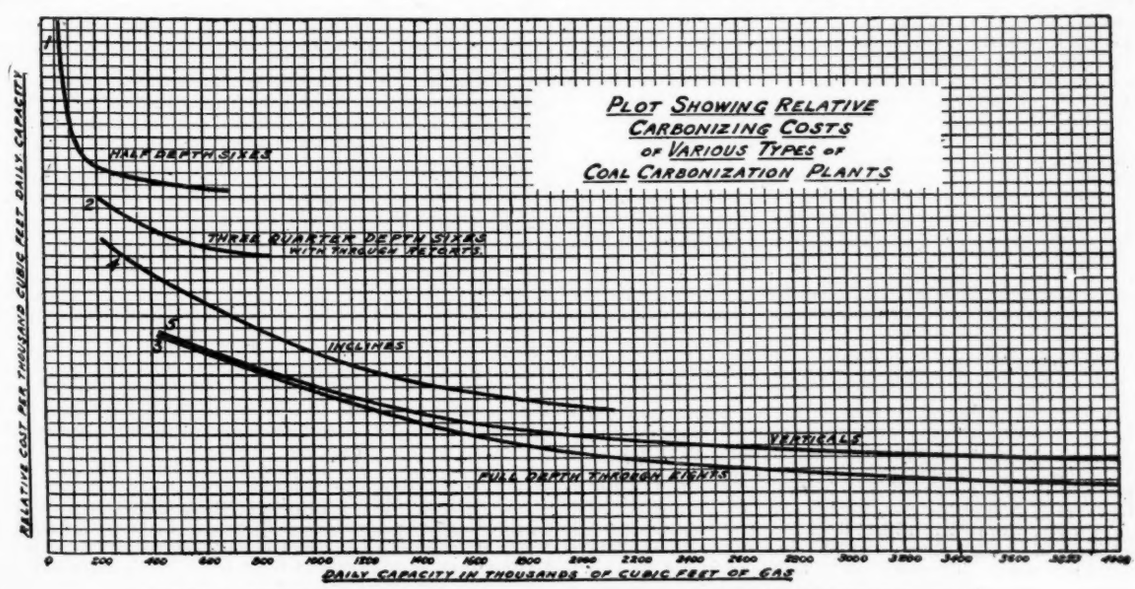


CHART 3.—RELATIVE CARBONIZING COSTS OF VARIOUS TYPES OF CARBONIZATION PLANTS.

in by hand in charging buggies, and the coke is quenched in wheel-barrows and wheeled to the coke-pile in the yard by hand labour.

Curve No. 2 represents horizontal through benches of sixes, with retorts about 11 ft. 6 in. long. In this type, the coal is brought into the retort-house in charging buggies by hand labour. The coke, however, is discharged from the retorts by means of a hand-pushing machine into coke-quenching shoots, from which the cold coke is discharged into cars running on an industrial track at the basement floor level, and taken to a platform elevator, and from there can be removed on an overhead trestle to yard storage.

Curve No. 3 represents in each case through horizontal benches of eights or nines, with retorts 16 feet to 22 feet long. The coal-handling machinery for this type includes: Receiving hopper, crusher, apron conveyor, bucket elevator, continuous coal-bins in front of the benches, and a power stoking machine to charge and discharge the retorts. The coke-handling machinery includes: Hot-coke conveyors to deliver the coke at the end of the retort-house either on to a cross conveyor or into a coke-bin. The benches are of full-depth type, and equipped with modern appliances for saving fuel, reducing clinkers, and for handling the tar and liquor within the limits of the retort-house.

Curve No. 4 represents plants having inclined benches with either ⌂-shaped retorts or rectangular slots; the machinery for bringing the coal to the benches being similar to that for the horizontal through eights, and the coke being quenched in shoots and delivered to cars running on industrial tracks, ready to be delivered to coke-bins or to yard storage.

Curve No. 5 represents vertical benches, with complete coal and coke handling machinery for bringing in the coal and charging it into the retorts, and for discharging and taking out the coke either to a coke plant or to yard storage.

General Considerations.

There are a considerable number of factors entering into the problem of choosing a type of plant. Some of these are enumerated: Whether the plant is to be entirely new or is to be an addition to an existing works or a remodelling of an old plant. The suitability of the plant to the local ground situation and environment and the ground space available. Output required. Investment cost, interest and depreciation, taxes, and insurance. Elasticity of production, quality of gas required, and cost of coal. Labour. Upkeep, such as repairs, supplies, power, steam, water, and light. Bye-products, kind of coke required, market for coke, tar, and ammonia. Fuel, whether gas, coal, or coke, and whether a saving in fuel is important.

The question is to decide which of these or other factors enter most strongly into the problem. Which products are the most valuable to obtain? Is one looking for a certain quality of gas or for a large yield? Is it necessary to obtain a certain candle power or a certain number of B.Th.U.? Is one looking for a special grade, or for a large quantity of coke; and does one wish to make coke for water-gas plants?

Comparisons.

These factors must all be considered, to determine what type of plant will be the most efficient from a commercial standpoint; and this is measured by the net profit on the investment resulting from operating the plant under existing local conditions.

Type No. 1, or stop-end sixes, are, of course, lowest in first cost of installation, and are easy to operate—requiring a minimum of expert supervision, especially in the smaller plants. The labour cost, however, is the highest per cubic foot of gas made, and the returns from the bye-products the lowest, This is due in part to the relatively small size of the charges, which vary from 250 lbs. to 400 lbs. in weight, and in length of carbonizing time, from four to six hours. The return from ammonia is especially small in this type; this bye-product being lost entirely in many plants. It is generally recognized that this is one of the very important items to be taken into account when considering the net cost of making gas; and apparatus for recovering this bye-product, even on a small scale, is being considered by many gas makers who formerly thought it was unprofitable to save the ammonia. As the units are small, this type of plant is quite elastic, and the output may be governed more easily than where larger units are installed. The fuel and steam cost is highest for this type; but the repairs are lowest.

Most of the factors relating to Type No. 1 also relate to Type No. 2. The cost of installation is somewhat higher; but this is more than balanced by the lower labour cost and an increased return from the bye-products. A greater output for the same ground area is obtained, due to heavier charges. This is made possible by the use of a pushing machine. This feature also accounts for a better quality of gas and an increased quantity and an improved quality of tar and ammonia. Deeper furnaces accomplish a saving in fuel. The upkeep charges are about the same. The charges range up to 600 lbs. of coal in an 11 ft. 6 in. length of retort; this amount being burned-off in six hours.

From a study of the charts, it is quite evident that the benches built according to Type No. 3—*i.e.*, horizontal through benches of eights or nines, with retorts 16 feet to 22 feet long—represent the lowest investment cost per 1000 cubic feet capacity for medium and large size works. These horizontal through benches are also capable of giving the largest make of gas per man, which means the lowest carbonization labour cost per 1000 cubic feet of gas produced. The yield of gas where heavy charges and high heats are worked is also greater than that obtained by other types of plants; and the fuel required is less than on any other known type of bench. The returns from residuals show up well in this class of bench; the percentage of coke and tar being large and the quality being good where the charges are heavy, and the amount of ammonia produced being second only to that of verticals. The upkeep in general is comparatively low, and the steam cost reduced to a minimum. The advantages of through horizontal benches have been thoroughly appreciated by gas companies in general. This is evidenced by the fact that, counting total daily capacity of output, more benches of this type have been installed during the past few years than any other. Another advantage of this type is the ease of operation; the coal and coke being handled entirely by machinery, and the benches being arranged with apparatus which permits of accurate control of the heats. The weight of charge ranges up to 75 lbs. per foot of retort; this amount of coal being burned-off in eight hours.

Plants built with inclined benches—*i.e.*, Type No. 4—need have very little power machinery; and inexperienced labour can be used in their operation. This class of bench is noted for ease of operation, and is therefore especially adaptable for moderate sized plants. Benches of the inclined type, with ⌂-shaped retorts at a steeper angle than formerly built, and slots, rectangular in shape, both small and large, with still steeper slopes, are coming into prominence more and more, and are showing better results with each new plant put into operation. The charges burned-off in inclined benches as constructed to-day vary from 900 lbs. of coal for ⌂-shaped retorts 15 feet long to 5000 lbs. of coal for large slots about 20 feet long. The time of carbonization is from seven to twelve hours, or longer if desired.

Vertical benches have several peculiar advantages—among them being the small amount of ground space required, the freedom from smoke and dirt, superior quality of coke and tar, and especially the large amount of ammonia recovered—this last being one of the deciding factors governing the choice of this type of plant. The cost of installation, however, is sufficiently high to prohibit this type being built at a great many locations.

Conclusion.

It has been the aim in assembling these data, and exhibiting the charts, to give due consideration to each type of plant without prejudice, and not to make recommendations for any particular type until given the conditions of operation. The plotted results of the investigations and studies have caused the firm to alter their previous views in some measure, and have strengthened some impressions they already had.

Attention is again called to a previous statement, that the curves show average results of a large number of plants. Any gas man may know of a particular works which will show-up better or worse than indicated on the charts.

COMMON OFF-TAKE PIPES FOR RETORT-SETTINGS.

American Proposals.

In the "Correspondence" columns of the "Journal" last week, p. 26, a letter appeared from Mr. R. C. Congdon, the Manager of the Atlanta (Georgia) Gas Company, controverting a statement recently made in a paper read before the Manchester District Institution of Gas Engineers, to the effect that Mr. H. A. Carpenter, the Vice-President of the Riter-Conley Company, had "invented a common take-off main and pipe for a large number of retorts, which enabled the construction of retort-benches containing a greater number of retorts than heretofore." Mr. Congdon forwarded copies of two American patent specifications that were frequently referred to during the hearing of the case in the District Court of the United States when the position of the respective parties was determined—as mentioned in Mr. Congdon's letter. There are reproduced below the drawings attached to the specifications; and also as much of the descriptive matter as is needful to make the patentees' ideas clear.

Rowland's Patent of 1879.

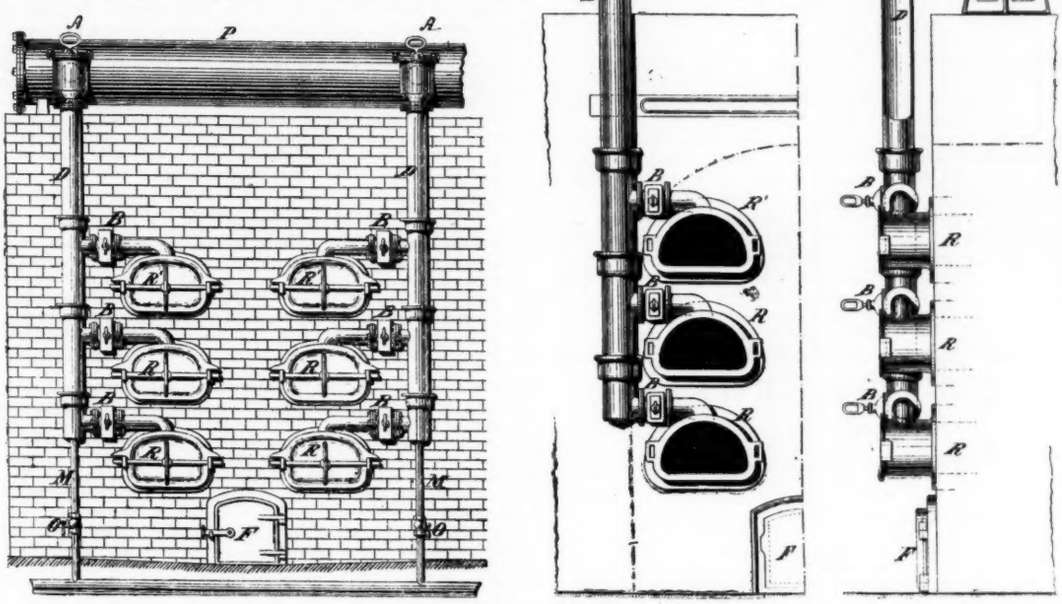
On June 5, 1878, Mr. Thomas F. Rowland, of New York, applied for a patent, which was duly granted to him on Jan. 21, 1879, No. 211,591.

In the specification he pointed out that it had reference to "those processes of gas manufacture in which a vapour is converted into gas by being passed through a highly-heated retort, called a 'fixing-retort.'" It was designed "to facilitate the removal or cleaning of these retorts separately without disturbing their operation as a whole, and also to allow of the escape of explosive impurities before they enter the heating retorts, thereby preventing the injury or destruction of the apparatus." He pointed out that, "owing to the very high temperature at which these retorts are maintained, it frequently happens that they are burned-out and destroyed; and it has been necessary when one of the retorts was destroyed to stop the mechanism until the retort could be replaced." The object of his invention therefore was "the shutting off of the currents of gas from the retort which

it is desired to replace while the other retorts of the series are allowed to operate."

In the illustrations are represented (1) a front elevation, showing a bench of retorts set in brick; (2) a section through certain other retorts at their rear; and (3) a section, at right angles to the other section, through the supply-pipe P and valve A.

The retorts forming each bench are heated from a central



ROWLAND'S ARRANGEMENT OF 1879.

furnace. The pipe P is connected, at intervals, with the stand-pipes D—each communicating with the vertical series of retorts. Each of the pipes is provided with a valve A, at its upper extremity, whereby it can be shut off from the supply-pipe P. The stand-pipes D are connected to the ends of the retort by the short pipes, each of which is provided with a valve B. Similar connections are used at the other end of the retorts. The eduction and induction pipes are similarly arranged at the front and rear of the retorts; and the corresponding valves should be simultaneously turned, in order to accomplish the results desired. At the bottom of the pipes D are escape-pipes M, provided with stop-cocks O.

The operation of the plant (in the words of the patentee) is as follows: Vapour is supplied to the fixing-retorts through the pipe P. It may happen that this pipe and the stand-pipe D contain air. In case such air passes into the fixing-retorts in company with the entering vapour, an explosion would occur. I therefore have attached the purge-pipes M, provided with stop-cocks O. These pipes M remain open until all the air has been driven out, when they are closed. In case the valves A and B are open, the gas passes down through the pipes D, through the retorts, and out at the back through similar pipes and connections, thereby being fixed or converted into a permanent gas. In case the upper retort should be in any way injured, the valve B and the corresponding valve at the other end are closed, when the gas passes by such retort and through the other retorts of the series. In case a whole bench should be burned out, the valve A should be shut, and the corresponding valve at the other end, when the gas passes along the pipe P without entering that series.

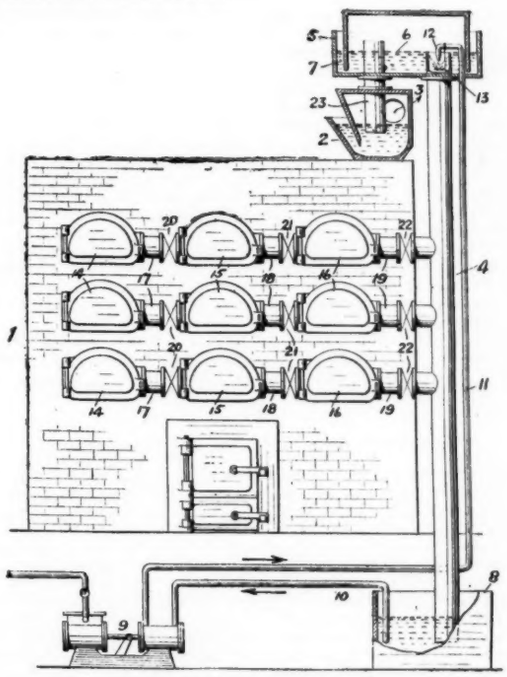
Congdon's Patent of 1914.

The patent applied for by Mr. Richard C. Congdon, of Atlanta, Georgia, on April 29, 1913, and granted on March 17, 1914, No. 1,098,138, had for its object "to prevent the accumulation of tar, pitch, and lamp-black inside the stand pipe [of a bench of gas retorts]; to scrub the gas in the stand pipe and thus lessen the burden on the balance of the works; to increase the capacity of the exhausters, condensers, and scrubbers; to rapidly cool the gas inside the stand pipe; to increase the candle power of the gas; to obviate the expense, annoyance, and work of cleaning the stand pipe at frequent intervals by manual or mechanical means; and to reduce the first cost of the installation, while attaining the advantages above recited."

Broadly speaking, and without disclaiming any novel features of the invention, the above objects were to be accomplished, according to the patentee, by the circulation of water, water-gas tar, or other fluid inside the stand pipe, but without getting it inside the retort or retorts connected to the stand pipe.

The invention is described in connection with a drawing, showing in elevation (partly in section) one form of apparatus.

In the illustration, 1 (more or less diagrammatically) illustrates a bench of coal-gas retorts; and 2, a hydraulic main having an off-take 3. 4 is a stand pipe. 5 is a tank having a bell, with which the stand pipe connects, so arranged that the fluid 6 may be made to overflow down the stand pipe 4. This equipment 5 performs the function of a bridge pipe, and connects the stand pipe with the hydraulic main. The seal of the equipment 5 is indicated at 7. At the lower end of the stand pipe there is a seal pot 8. The pump 9 serves to withdraw fluid from the seal pot by the pipe 10 and deliver it by the pipe 11 inside of the stand-pipe. As shown, this pipe is provided with a nozzle 12 and spray device 13, arranged to discharge into the extreme upper end of the stand pipe somewhat farther down it.



Congdon's Arrangement of 1914.

The retort 14 is connected by a valved connection 17 with the retort 15; and the retort 15 is connected by a valved connection 18 with the retort 16. The retort 16 is connected by a valved connection 19 with the stand pipe 4. Of the valves, 20, 21, and 22, the valve 22 serves to disconnect the row of retorts from the stand pipe, and the valves 20 and 21 serve to disconnect the retorts from each other.

In use, fluid is circulated through the stand pipe 4—meaning that it is introduced into, and withdrawn from, the stand pipe.

Furthermore, this fluid does not pass from the stand pipe into the retorts. The fluid thus circulating through the stand pipe, preferably in the form of a spray or shower, not only keeps the stand pipe clean, but also scrubs and cools the gas in its passage through the pipe on its way through the bridge pipe 5 and drip pipe 23 to the hydraulic main.

This scrubbing and cooling of the gas in the stand pipe relieves the rest of the apparatus [not shown] from much of its work—thus increasing the capacity of the plant and reducing the first cost of the installation. Water-gas tar can be used as a circulating fluid. Inasmuch as the stand pipe is kept practically clean, it is said to be possible and practical to connect a great number of retorts to a single pipe, and thus the first cost of installation, as well as the cost of operation, are reduced.

In his description of the operation of the valves between the retorts and stand pipe, the patentee says: Assuming that the retorts are up to heat and ready to receive the coal, the charging is accomplished for each horizontal row as follows: Close the valves 22 of the two top rows and open the valve 22 of the bottom row; in the bottom row close the valves 20 and 21 and charge coal into the retort 16, then into retort 15; as soon as retort 15 is charged, open the valve 21 so as to let gas pass from 15 to 16 and into the stand pipe; as soon as retort 14 is charged, valve 20 may be opened. And so on, for the other rows.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Mr. Charles Carpenter's "Will o' the Wisp."

Sir,—It will be regarded as unfortunate by many of your readers who are responsible for the conduct of gas undertakings that one in the position of Mr. Charles Carpenter should associate the practices of adulteration and dilution with the authorized systematic extraction of benzol and toluol from coal gas.

Apart from this unfortunate association, and however much we may disagree with the standard of calorific power he proposes to maintain and the restriction in manufacturing methods it is understood he favours, we may readily agree that his plea for the supply of "gaseous energy" rather than "gaseous volume" is made in the permanent interests of gas supply.

It is undoubtedly our duty to the public to supply combustible gas free as far as possible from admixture with nitrogen and furnace gases.

The careful exclusion of these gases will also allow of a regulated strip, resulting in a definitely increased yield of benzol and toluol, and still leave the gas sufficiently carburetted (if it is desired) to produce luminous flames.

The gas as made and partially stripped will have its calorific value reduced from 6 to 8 per cent.; but its flame temperature will be higher and incandescent mantle lighting will often be improved. It does not follow that, under all circumstances, more gas will be required to do a given amount of heating duty. The bunsen flame of a partially stripped gas is shorter, the heat is more concentrated—say, under a kettle—and less is wasted up the sides of such a vessel.

My chief object in writing is to express a fear that the title of Mr. Carpenter's letter, also his method of treating the subject, will have the effect of providing excuses for the use of those who are so slow in grasping the seriousness of the demand and the importance of everyone doing his full share, and not leaving the provision of benzol and toluol to someone else.

The German method of governmental control would have left us no alternative. Under British freedom, we have the opportunity of voluntarily helping the State; and if our patriotism is of a worthy quality it will triumph over deep-rooted commercialism, and the selfish clinging to old standards.

I trust, therefore, the "Will-o'-the-Wisp of Uncarburetted Hydrogen" letter will not frighten anyone from adopting a reliable and systematic method of increasing the yield of benzol and toluol.

THOS. GLOVER.

Norwich, July 8, 1916.

Gas Engineering—A Unique Opportunity.

Sir,—Now that there is a movement afoot to place the gas industry upon a more effective basis, there arises anew the question as to the status that gas-plant manufacturers hold in the hierarchy of the gas engineering profession.

The Institution of Gas Engineers does not admit to its roll of membership engineers who hold positions with contracting firms. By so doing, the relative loss to the technical and scientific sides can be appreciated best by contrasting the virility of this small Institution with that of bodies representative of some other branch of engineering that actually do admit such men. Our leading engineering institutions in London, and some of the splendid examples that are to be found in the Provinces—among the latter being the North-East Coast Institution of Engineers and Shipbuilders, the Manchester Association of Engineers, and the South Wales Institute, not to mention any others—as a whole, admit members of contracting firms, provided, of course, that their regulations in respect of qualifications, &c., are complied with. It can scarcely be credited that the Council of the Institution of Gas Engineers hold the opinion that the inclusion of such engineers would be of little benefit from a technical point of view, and that gas engineering as a profession would not gain some advantage from any contributions to the "Proceedings" of the Institution that contractors' engineers might be able to make.

Comparisons may be odious sometimes; but they often serve as an effective stimulant to the less enviable of the compared. The Institution of Electrical Engineers, which is purely a technical body, admit to their highest grades of membership men holding positions in engineering firms engaged in manufacturing electrical plant, as well as those who occupy posts as electrical engineers under municipal bodies or in large power stations, as well as consultants—provided that the individuals hold the requisite qualifications. An examination is now held for candidates desiring associate membership.

Having had experience in both the electrical and the gas manufacturing industries, I am of opinion that the greater effort and endeavour and keener desire to continue to progress shown in the electrical industry generally, as compared with that in the gas industry, is in some considerable measure due to the fusion of interests of which I have already written. The majority of advances and improvements in electrical machinery and in methods of generating electricity are made by men associated with the manufacturing side of the industry. If the proceedings of the Institution of Electrical Engineers be analyzed, one will discover that a large number of the men who contribute papers and take part in subsequent discussions are drawn from the ranks of the manufacturers.

Are we, then, to conclude that these contributions to the proceedings of this large and influential body of engineers are prompted mainly by mercenary motives? No, Sir. In the majority of cases the contributions spring from a deep interest in the engineering profession, and a desire, on the part of those who take part, to feel that they have added something to the growing pile of recorded engineering experience and knowledge. The electrical engineer engaged in manufacturing and his *confrère*, for whom the products of the factory are made, walk together beneath the ægis of their large, influential, and magnificently housed Institution.

The Institution of Gas Engineers is also a technical body whose aim should be to further technical advancement by all possible means. It would be ridiculous nowadays for the argument to be brought forward that improvements in gas manufacture and in plant cannot be advanced by the meeting together of manufacturers of gas plant and users of it to hear papers read and to take part in discussions upon the subjects of these contributions. Of course, both sides will benefit materially by the expressions of opinion pronounced, and the personal experiences narrated, at such assemblies. Meetings of this kind sometimes mark the beginnings of important projects.

Let us try to imagine the present influential Institution of Electrical Engineers composed almost exclusively of engineers and managers of power stations, consulting engineers, and engineers in charge of electrical undertakings; and the picture we shall form will represent almost exactly what the Institution of Gas Engineers is like to-day.

There is wanted an Institution representative of the whole of the gas engineering profession. It must actually lead the profession, and include everything and everybody closely connected with the manufacture of town, coke-oven, producer, and other industrial gases, and of all apparatus used in their manufacture. It ought also to include those interested in the manufacture of gases by synthetic processes. Proper qualifications as engineers should be required of all candidates for election; and these requirements should be sufficiently searching to keep up the status, and make membership of the Institution an honour worthy of attainment.

Has not the Institution of Gas Engineers a unique opportunity of rising to the occasion, and of placing itself at the head of the profession? If it does not realize this, it may have to give place to an Institution that does. But, before it can fittingly place itself in the position it ought to occupy, there must be signs of contrition on its part—a little less self-satisfaction, less boastfulness, and a little more seriousness might with advantage characterize some of its meetings.

Many leading engineers, scientists, and public men have drummed it into the country that the Allies have to face a keen commercial war, the like of which has never been seen, after the conclusion of the present military conflict. Will not then the nation be best served and the gas industry as well by the welding together of the profession into one strong and corporate whole?

NEW AGE.

July 8, 1916.

"Traders."

Sir,—Your leading article under the above heading is straight to the point, and should certainly bring to the minds of one or two men of advanced years that the old order of things has now changed, and that it is the engineering contractors who can lay claim to being the experts in construction of gas-works. They have a free hand as regards time and travel, and spend their money to the direct advancement in the constructional technology of gas-works. The word "trader," in my opinion, includes all those engaged in gas and residual product making as much as those engaged in construction and equipment in any form. It is the "gas-works monopoly" which has had the unfortunate effect on some minds of making them believe that they really exist on a superior plane, just because they give the orders and contracts. One does not find this state of affairs in large businesses in competition with one another.

The so-called "trader," in my opinion, has certainly more experience in his branch than any chairman, manager, or other official of a gas-works can possibly aspire to. Therefore, why should there be this obnoxious defining line of status? Years and years ago in the gas industry the engineer and manager was the consulting expert to the contractor and manufacturer. But this state of affairs no longer exists—the boot is on the other leg. Engineers and managers to-day keep no large drawing offices—in fact, they seldom keep a detail draughtsman on the premises. The drawings supplied by engineers and consulting engineers nowadays are black-lined drawings, merely giving positions or locality of plant. The process and detail—the latter being the essence of engineering—are left to the engineering contractor to bring out to the best of his ability as regards showing the highest state of efficiency in working. The old style of the consulting engineer, so called, supplying "repeat" drawings, and with no desire to improve on mechanical detail or working results, is dead. Elaborate castings, in a multitude of shapes, are displaced by work which can enter into competition. Even to-day some consulting engineers are erecting plant which has been out of date for many years, but which

is embodied in their category of "What was good enough for my father is good enough for me."

The modern methods bring the engineering-contractor trader on the same plane as the "gas manager trader," so that there is no reason for the engineer or manager of a gas-works to imagine that he is more entitled to become a member of the Institution of Civil Engineers, for instance, than the engineering contractor. All the corporate members of the Institution of Civil Engineers of the earlier days were elected without examination. Nowadays, an examination existing, I strongly recommend that the gas profession should see that the rights of their students are duly protected, in the event of them being articled to engineering contractors; otherwise they will suffer the same fate as myself, by being told that "advertising engineering contractors," even though they pay the annual fees for years, and carry out design and construction, are not eligible for full membership.

I am given to understand that all applications for election to the Institution of Civil Engineers from those connected with gas-works are advised upon, and recommended or not, by a London gas engineer. This is a one-man affair; and I think that the responsibility should be divided between a Committee of (say) seven full members, so as to ensure that a man gets fair play and consideration. Otherwise one can only surmise that the old-time thoughts of being a "trader" or "contracting engineer" has to suffer for no other reason than that it does not meet with the approval of the member of the Council selected to deal with the gas applications. I am glad to have had the opportunity of speaking my mind on points barred to me when I was in the ranks of the engineering contractors.

MAURICE GRAHAM,
Assoc.M.Inst.C.E. (1893).

51, *Albert Hall Mansions*,
Kensington Gore, S.W., July 8, 1916.

Loughborough Gas Undertaking.

The report of the Gas Committee, dealing with results of the past year's working, was presented at last week's meeting of the Loughborough Town Council. It showed a gross profit of £6978, compared with £6847 in the previous twelve months; the expenditure being £17,567, against £15,652 in the preceding annual period. Mr. Charles (the Chairman of the Committee), in moving the adoption of the report, mentioned that, whereas the number of ordinary gas consumers in 1915 was 2131, these had fallen to 2083 in the period under review. In the two years the number of slot-meter consumers had, however, risen from 3520 to 3588. The decrease in regard to the quantity of gas made was 5,518,003 cubic feet, or 4·24 per cent. He pointed out that the Council could hardly expect a very rosy balance-sheet, considering the very large increase which had occurred in the price of coal, coupled with the low rates received from the sale of residuals; but, having regard to all the untoward circumstances, the result of the year's trading was satisfactory.

Gas Profits at Birkenhead.

The Birkenhead Town Council were informed at their last week's meeting by Alderman J. H. M'Gaul (the Chairman of the Gas Committee) that the year's trading was satisfactory, in view of the various drawbacks they had had to face—the restricted public lighting and the increased cost of coal, rates, and taxes, amounting to something like £9000. The year, he said, showed a gross profit of £46,216, as against last year's profit of £25,365. Interest and sinking fund absorbed a very much larger amount than in previous years—£26,232—leaving a profit of £19,984. Out of this sum, they had spent on works of a capital nature, for which they could have borrowed in the ordinary way, £2129. To the remaining sum of £17,855, they had added £5893 in hand, leaving a total divisible profit of £23,748. After consultation with the Borough Treasurer, the Committee proposed to dispose of this as follows: In aid of the borough rates, £7874; to reserve fund, £4000; to a special reserve fund, £4000; and to the reduction of price account, £7874. The renewal and special reserve funds now stood at £29,770, equal to 8 per cent. on the outstanding debt on the gas-works (£365,000). He was somewhat pessimistic as to next year's results. At the present time they were sending out 1,000,000 cubic feet of gas less per week than they had done for many years, and they were also having to pay an increased price for coal. They were unable to contract for stores, and were compelled to purchase them as they were required. Still, with judicious management, he thought that the Committee would again be able to come to the relief of the rates as they had done in the past.

An Adverse Balance at Wenlock.—At a meeting of the Wenlock Corporation, it was reported that there was an adverse balance on the gas account of £500; and the Chairman (Alderman Cooke) remarked that the Daylight Saving Act was "practically killing the gas trade."

Malta and Mediterranean Gas Company.—At the annual meeting of the Company to-day, when the audited accounts for the year ended March 31 will be presented, the Directors will report that the balance of the general revenue account is £6388. They will recommend the payment of the usual dividends on the first and second preference capital, and a dividend of 4 per cent., free of income-tax, on the ordinary capital, making, with the interim dividend paid in December last, 6 per cent. for the year. This will leave a balance of £1211 to be carried forward.

Fylde Water Board.—The seventeenth annual report of the Fylde Water Board, which is composed of representatives of the county borough of Blackpool and the urban district councils of Fleetwood, Lytham, and St. Annes-on-the-Sea, shows that on the year ended March 31 last the gross profit, compared with the previous twelve months, fell from £59,185 to £57,872, a decrease of £1313, which is attributed to the restricted supply of water for trade purposes during the summer of 1915. This decrease, coupled with the interest paid on new loans, increased income-tax, &c., makes the loss during the year on net revenue account £5402, as against a loss of £648 in the preceding year.

REGISTER OF PATENTS.

Gas and Liquid Coolers and Gas-Scrubbers.

YATES, W., and MATTHEWS AND YATES, LIMITED, of Swinton, near Manchester.

No. 8762; June 14, 1915.

This invention, relating to gas and liquid coolers and gas-scrubbers, has reference to apparatus embodying a liquid container having therein a rotary drum made up of a plurality of thin discs threaded alternately with narrow spacing collars on a rotary shaft, and clamped between end plates—gas being caused to pass through the passages formed between the discs, and the lowermost portion of the drum dipping into the liquid in the container.

The discs are arranged in a casing having inlet and outlet openings on opposite sides, so that the peripheral edges of the discs are presented to the openings, and guide plates extend inwardly from the inlet and outlet openings in the casing towards the peripheries of the discs, whereby the gas or air passes between the discs and short-circuiting over the top of the discs is said to be prevented.

Gas-Heated Flat Irons.—No. 100,004.

HABICHT, F. P., of Schaffhausen, Switzerland.

No. 123; Jan. 4, 1916. Convention date, Jan. 5, 1915.

This invention relates to gas-heated flat-irons provided with a rotatable body portion, so as to permit both sides of the iron to be used alternately. A great difficulty with flat-irons of this description is said to be the device for securing the iron in one or other of its operative positions; it being essential for the satisfactory manipulation of a flat-iron of this kind that the iron should be absolutely rigidly secured in its operative positions, while at the same time its reversal can be effected in the simplest possible manner.

According to the invention, an adjusting rod, connected to the pivoted body portion of the iron eccentric to its axis of rotation, is arranged to be automatically secured to the handle by a snap-coupling, and upon its release (by a pulling action) to reverse the iron, whereupon it is again automatically secured in a position symmetrical to the previous position. The operation of reversing is said to be an easy one, and is "in no way dangerous," and, moreover, the flat-iron is held rigidly in its two operative positions.

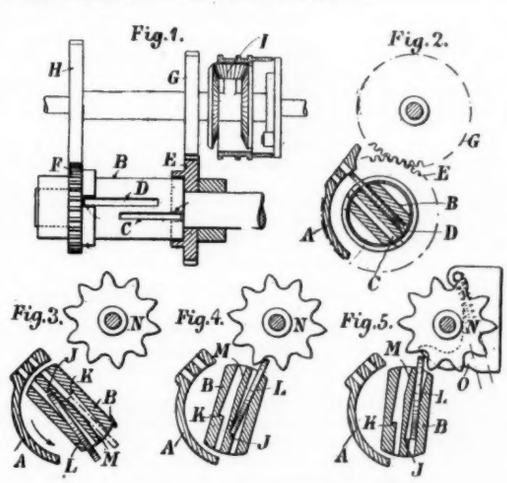
Coin-Operated Meters.—No. 100,410.

COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATÉRIEL D'USINES À GAZ, of Paris.

No. 6548; May 11, 1915. Convention date May 2, 1914.

This invention is a modification of that described in patent No. 6548 of 1915, according to which the casing and the barrel of the meter are provided with two slots in different planes parallel to the barrel axis and to each other, adapted to receive coins of different values that respectively engage with a gear of a diameter corresponding to the value of the coin. The invention further comprises a single barrel provided with two slots located in different planes parallel to the barrel axis and to each other, in one or the other of which the coin introduced combines with retaining shoulders or pins arranged in the walls of the slots, so as to form a point of support for the coin during the whole time of its action on the gear which acts on the meter mechanism.

Fig. 1 is a longitudinal section, and fig. 2 a cross-section showing the improvements referred to; and figs. 3 to 5 show (in cross-section) three different positions of another construction.



A French Coin-Operated Gas-Meter.

In the construction shown in fig. 2, the casing A has two openings, and the barrel B (figs. 1 and 2) two corresponding slots C D, intended to receive coins of different values—such, for instance, as a nickel coin of 25c. and a silver coin of 50c. These slots are arranged in staggered

order, so that they extend respectively under the collars on two gear wheels of different diameters E F which are mounted loosely on the barrel, and engage with other toothed wheels G H secured to the differential I. These collars are provided with recesses which are opposite the slots C D when the barrel is in its initial position of rest.

In these conditions, when a coin is introduced, it couples the barrel to one of the toothed wheels E F. When the barrel is turned, the coin drives the coupled toothed wheel, which, in its turn, acts on the differential device, while the other toothed wheel rotates loosely on the barrel. The ratio of the wheels E G and F H is calculated so that the differential I advances to an extent corresponding to the value of the coin introduced.

In the modified construction shown in figs. 3 to 5, the barrel B is also provided with two slots having a reduced passage on the side opposite to that at which the coins are introduced, and having inside shoulders J K made in the thickness of one of the walls of each slot and co-operating with inclined planes L M provided on the walls, so that when the coin is introduced, it automatically assumes an inclined position under the action of its weight and engages with the corresponding shoulder of the barrel. It follows that when the barrel is rotated in the direction of the arrow in fig. 3, the projecting portion of the coin will act on the toothed wheel N to turn it to the extent of one tooth—fig. 4. A little before the end of the rotation of the barrel, the direction of the thrust exercised on the coin by the arm of the pawl O, which it has just raised, will be reversed, owing to the special cross-section of the end of the arm, so that the coin will oscillate in the barrel (fig. 5) owing to contact with the shoulder, and will be finally ejected from the barrel by the action of the return spring of the pawl.

Atmospheric Gas-Burners.—No. 100,310.

NEEDHAM, J., of Passaic, U.S.A.

No. 5145; April 7, 1916.

Means are provided within a mixing chamber of a burner for simultaneously regulating the gas supply and the internal air supply.

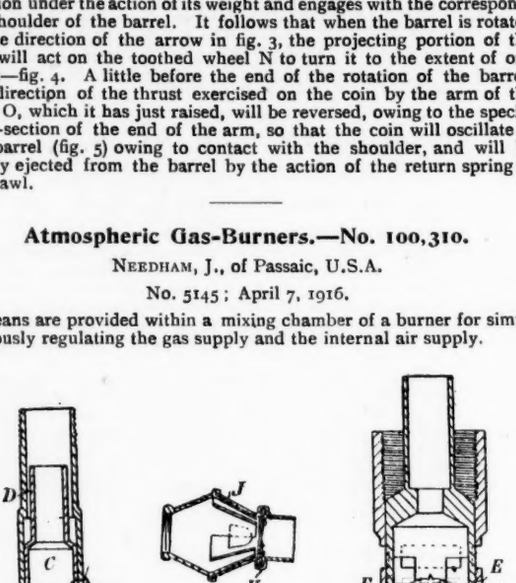


Fig. 1. Fig. 3. Fig. 2.

Needham's Atmospheric Gas-Burners.

In the form shown in fig. 1, the nipple A is slidably mounted on an axially-arranged fixed regulator B, and is secured to the rear end of an air regulating tube C slidably mounted on the mixing-chamber and having an extension D, of less diameter, projecting into the mixing-tube; transverse slots in the tube C being adapted to register with transverse slots in the mixing-chamber. The tube C is secured in position by a set-screw passing through a longitudinal slot in the mixing-chamber.

In the modification shown in fig. 2 the combined air-regulator E and gas-nipple F is screwed on the tubular part of the fixed nipple regulator G, and is formed with a serrated rear part operated by inserting the fingers through slots in the mixing-chamber; the combined regulator and nipple being retained in position by a spring H engaging the serrated part. The rear end of the mixing-chamber screws on I.

In fig. 3, a rotary hit-and-miss regulator J, mounted on a mixing-chamber, has a trough-shaped flange K engaging over a fixed flange, and carrying pins which operate the crescent-shaped blades of an iris diaphragm forming the top of the gas-nipple. The mixing-chamber, formed of two truncated cones, is longitudinally slotted. The regulator J is secured in position by a set-screw passing through a slot in it.

Raising or Forcing Liquids or Elastic Fluids.

HUMPHREY, H. A., of Victoria Street, Westminster, and RUSDELL, W. J., of Wolverhampton.

No. 8890; June 16, 1915.

This invention relates to internal combustion pumps without a fly-wheel which raise or force liquids or gases by the energy of expansion of an ignited combustible mixture.

In the patentees' previous specification, No. 11,818 of 1911, there was described an internal combustion pump without a fly-wheel adapted to raise or force liquids, or compress elastic fluids, by the energy of expansion of an ignited combustible mixture, wherein a solid mass, or linked solid masses, capable of acquiring momentum sufficient to limit the velocity of the liquid or gases through the valves to that required in practice, reciprocate continuously and freely without control otherwise than by work done or energy stored, or both, at each stroke—the momentum aiding the compression of the combustible mixture, or a constituent thereof, before ignition to the desired pressure in a combustion chamber by an inward stroke of the reciprocating masses towards the chamber.

In connection with the apparatus they described means whereby energy is stored during each stroke—such as by compressing elastic cushions or raising weights for the purpose of effecting or assisting the next stroke. In accordance with their present invention, they use one or more separate cushions other than that constituted by the combustible charge, or constituent thereof, in such a manner that the cushions are not compressed on each stroke when the apparatus is working normally, but only come into operation when starting the apparatus from rest, or on decreased external work resistance, or when greater energy is generated on combustion, or when, for any other reasons, the length of the stroke increases.

In the apparatus constructed in accordance with the invention, the power unit or units are adapted to work on any of the known cycles of internal combustion engines, and to operate with gaseous or liquid fuel. The simplest combination is that in which the power unit has one two-cycle combustion chamber, the piston of which is rigidly connected to the piston of a pump for liquids or gases. Where four-cycle power units are employed, it is, they say, generally advisable to have two units combined and operating alternately, so that each outstroke becomes a power stroke; and any number of power units may be combined with any number of pump units, and the connections between them may be of the rigid or linked type.

The output of apparatus of given dimensions necessarily depends, they point out, upon the speed at which it can be operated; and to obtain greater speed of operation and thus a greater output, they have made certain improvements in the design and arrangement of valves and air-vessels. In previous specifications they described devices for controlling the operations of internal combustion pumps; and many of these devices are, with suitable modification, applicable to the present invention.

The foregoing general statement is illustrated by reference to a set of four sheets of drawings showing sections of the several forms of pump and accessories thereto operated and constructed according to the invention, which is not further described apart from the closely-lettered figures.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for July 5.]

Nos. 8936—9265.

BURLINGHAM, W.—"Lined tubes." Nos. 9223-4.
DEHN, F. B.—"Conversion of hydrocarbons." No. 9186.
KEITH, G. & J.—"Gas-lighting torch." No. 9221.
LINDBLAD, A. R.—"Production of cyanogen compounds." No. 9183.
M'LACHLAN, R. W.—"Shade holders." No. 9062.
ROCK, W. D.—"Treatment of carbonaceous and hydrocarbon-containing material." No. 9230.
Synthetic Hydrocarbon Company.—See Dehn. No. 9186.

APPLICATION FOR RESTORATION OF LAPSED PATENT.

Notice is given that CHARLES RIDLEY has made application for the restoration of the patent granted to him for "Improvements in the methods of obtaining gases from solids," No. 15,000 of 1908, dated July 15, 1908, which expired upon July 15, 1914, owing to the non-payment of the renewal fee.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:

Bill brought from the Commons, read the first time, and referred to the Examiners: Local Government Provisional Orders (No. 7).
Bill read a second time: Conway and Colwyn Bay Joint Water Supply.
Bill read the third time, with the amendments, and passed: Wakefield Corporation Water [a further amendment made].
Bills returned from the Commons, with the amendments, agreed to: Folkestone Gas, Plymouth and Stonehouse Gas, Uxbridge Gas. These Bills now await Royal Assent.

HOUSE OF COMMONS.

The following further progress has been made with Bills:

Bills reported, with amendments: Aberdare and Aberaman Gas [Lords], Hornsey Gas [Lords].
Bills read a second time and committed: Newcastle-upon-Tyne and Gateshead Gas [Lords], Yeadon Water [Lords].
Bill read the third time and passed: Local Government Provisional Orders (No. 7).
Bills, with amendments [Lords], agreed to: Folkestone Gas, Plymouth and Stonehouse Gas, Uxbridge Gas.

Bill considered in Committee and reported (without amendment) read the third time, and passed: Gas (Standard of Calorific Power Bill.

The Colchester Gas Bill [Lords] has been referred to the Committee on Unopposed Bills; and the Newcastle-upon-Tyne and Gateshead

Gas Bill has been added to Group B of Opposed Bills, and is to be considered on Thursday.

The Select Committee on Standing Orders on Wednesday reported: "That, in the case of the Conway and Colwyn Bay Joint Water Supply Board [Lords], petition for Bill, the Standing Orders ought to be dispensed with, and that the parties be permitted to proceed with their Bill."

Petitions have been deposited against the Newcastle-upon-Tyne and Gateshead Gas Bill [Lords] by the following: Newcastle-upon-Tyne Corporation, Durham County Council, Messrs. Brotherton and Co., Limited.

The South-Eastern and London, Chatham, and Dover Railways Bill, which was opposed by the Gas Light and Coke, South Metropolitan, and Wandsworth Gas Companies when before the Marquis of Bristol's Committee of the House of Lords [see "JOURNAL," May 23, p. 401], was rejected on Monday of last week on the motion for its second reading.

Coal Production.

On Monday last week, Mr. MILLAR asked the Under-Secretary for the Home Department how far the recommendations made by the Home Office Committee on Coal Production during the war had been carried out; and what steps had been taken to obtain the maximum output of coal at the collieries?

Mr. BRACE replied that it would not be possible within the limits of an answer to give all the information desired by Mr. Millar. He would find some particulars in the second report of the Coal Mining Organization Committee, and additional information would be given in a further report which will shortly be submitted. As a result of the steps taken, a marked reduction in absenteeism had already been effected. Holidays had been curtailed, and the number of days worked increased by the abandonment of customary stop-days. At the present moment, after conference between the Mining Association and Miners' Federation, special measures were in course of being taken to bring about a still further reduction in absenteeism. It had also been decided that no more men were to be recruited for the forces from among the miners. The Government were fully alive to the great importance of taking all possible steps in order to increase the available supplies of coal.

Mr. MILLAR further asked whether any inquiry had been instituted by the Home Office as to the causes of the short time being worked at some collieries; and what steps had been taken to secure the working of the pits as continuously as possible throughout the week?

Mr. BRACE said that the Coal Mining Organization Committee had given close and constant attention to these questions, and he would refer Mr. Millar to the two reports which had already been issued by the Committee.

Electricity Charges.

Sir FRANCIS LOWE (yesterday week) asked the President of the Board of Trade whether, in view of the fact that the Government were appealing to everyone to economize during the war, and that one of the objects of the Summer Time Act was to assist them in doing so, he would introduce legislation limiting the charges of electric lighting companies and local authorities in proportion to the saving of expenditure which they were able to effect during the operation of the Act.

Mr. HARCOURT said that the chief object of the Summer Time Act was to effect economy in the use of coal by public utility bodies. He was not prepared to introduce legislation in the direction suggested, as any reduction in the charges for electricity might encourage consumers to increase their consumption, and this would involve a corresponding increase in the use of coal by the supplying authorities. Further, the saving to the undertaking on the cost of the fuel economized was probably more than outweighed by the loss of revenue, owing to the reduction in the amount of current supplied.

Sir F. LOWE also asked Mr. Harcourt if he was aware that the opinion was very generally held that the action of these electric lighting bodies was not only bad form, but very unpatriotic, and ought not to be encouraged by the Board of Trade?

Mr. HARCOURT replied that he did not think he ought to express an opinion upon this point.

COLCHESTER GAS BILL.

The Bill of the Colchester Gas Company was down on the list of Bills, the commencement of the consideration of which by the House of Commons Committee, presided over by Sir William Middlebrook, was fixed for last Wednesday. No parties, however, put in an appearance in respect of the Bill, which now goes to the Unopposed Bills Committee of the House of Commons.

The Colchester Corporation—the only opponent in the Lords—have withdrawn their petition; and consequently abandon the request for a purchase clause, which took up so much time before a House of Lords Committee a short time ago. A number of minor amendments have been made in the Bill—the principal one of which is that the Corporation are to be allowed in respect of public lighting 3d. per 1000 cubic feet advantage as compared with the charge made to the ordinary lighting consumer.

Welsbach Light Company.—The report of the Company for the year ended March 31 shows a net profit of £18,949, to which is added the balance carried forward from last year, making a total of £24,658. The Directors recommend a dividend of 2½ per cent. per annum on the share capital of £265,000, less tax, carrying forward £18,033, subject to any liability for excess profits duty. No dividend has been received in respect of the Company's shareholding in the Austrian Company since the year ended March, 1913. It is proposed to alter the Articles of Association so as to provide that no one but a British subject shall be qualified to act as a Director of the Company.

GAS (STANDARD OF CALORIFIC POWER) BILL.

Debate on the Second Reading.

In the House of Commons last Tuesday, the second reading was moved of the Gas (Standard of Calorific Power) Bill, the text of which was reproduced in the "JOURNAL" for June 6 [p. 500].

Mr. J. KING remarked that it was an extremely good Bill—at any rate in its object, which was the substitution for the illuminating standard of gas of a heating standard. This he wished to see achieved. In the old days of flat-flame burners, it was of the utmost importance to have gas of good illuminating power; but now there were hardly any burners of this kind left. Mantles were used, with which light was obtained from heat; and a great deal of gas was consumed in cooking and heating stoves. It was therefore quite right that the standard should be altered. But why was this done at the present time? It was not emergency legislation at all, but greatly belated legislation, which ought to have been carried through long ago. Very likely, however, it was better to carry it through now than to put off the time. The Bill was to enable the Board of Trade or the Local Government Board to make an Order by which any gas undertaking might alter its standard of power. There were an enormous number of these undertakings in the country; and all of them could immediately, if they got an Order, reduce the illuminating power of their gas, with great advantage to themselves, as well as to the consumers—if they reduced the price. According to the last issue of a voluminous, and rather uninteresting and unnecessary, return issued every year—which showed what a very great industry this gas business was—there were 831 undertakings in the country. He would certainly like to know whether they were all coming at once for Orders, and, if so, would they all be granted immediately? There was no less a sum than £160,000,000 invested in the undertakings; and the yearly expenditure was £28,000,000. Thus, to alter the whole basis of the gas industry, as the Bill did, was no small task; and there should be some assurance as to how the measure was to be worked, why it was wanted at the present moment, and whether the authorities were in a position to deal fairly with all the localities at one time. Turning to the Bill, he saw it was provided that, in considering the expediency of making Orders, the Department were to have special regard to whether the undertakings had worked, or were prepared to work, suitable crude benzol recovery plant for the production of benzol and toluol. That was to say, the concerns which were to have the benefit of these Orders were to be encouraged to go into the chemical trade—a very desirable thing at this time—to obtain as much as possible of the raw materials of high explosives and of many industries for which this country had in the past been largely dependent upon Germany. In other words, gas undertakings, which were not established primarily to do chemical work, were to be encouraged to erect plants. If the gas concerns were told that they were not to have the benefits of this Act unless they did put up these plants, and there was consequently an enormously increased production of these bye-products, it might mean that the price would go down. Another point was that the accounts for the gas and the chemical portions of the business ought to be kept separate. Otherwise they would be allowing the undertakings to give to the public at no reduction of price possibly an inferior article, while speculating, and perhaps losing heavily, in the chemical industry. The public, as gas consumers, ought to have their interests safeguarded in this matter. People might get an article which was produced very much more cheaply; but he could find no provision that, when this cheaper article was supplied, the consumers were to pay less, or get any benefit at all. The Bill, perhaps rightly, left a good deal to the Department as to the conditions under which the Orders would be granted.

Sir NORVAL W. HELME, in supporting the Bill, said the public would gain by it, inasmuch as now probably no more than 5 per cent. of the gas was used for purely illuminating purposes. The principle had recently been adopted in many Private Bills. With incandescent burners, the higher the calorific power of the gas, the greater was the light obtained; and there was economy for the public in the use of these burners. The old tests were obsolete; and the Government were to be congratulated on the fact that by the Bill they were going to bring the practice of the day into harmony with the general law.

Sir W. PEARCE said he also welcomed the Bill, because he thought it dealt with a matter which really required altering. He did not see that there was any disadvantage to the public in it. The change of test would be some small financial help to gas undertakings, who certainly required a return for the large operations many of them had undertaken at the instance of the Ministry of Munitions in increasing the supply of benzol and toluol. In view, however, of the fact that these operations of the gas companies were becoming very considerable, and in some cases more than that—almost a larger production than the gas itself—he would have been glad to see included a clause providing for the financial separation of the two parts of the business. This was required in the interests of everybody—including the gas companies, who would thus know exactly how much profit they were making on their various operations.

Mr. W. THORNE expressed a desire to know whether the Government intended to give consumers some compensating advantage for what they would lose by the Bill. He believed that when some of the London companies promoted Bills for the purpose of reducing the illuminating power of the gas from 16 to 14 candles, provision was made for a compulsory reduction of 2d. per 1000 cubic feet in the price of gas. The reason for this was the amount saved on enrichment charges. He did not know whether there was anything in this Bill giving the Government power to reduce the price of gas; but, if not, there should be. The consumer was entitled to a reduction of 2d. for the change. Had it not been for the introduction of gas-mantles, the companies would not have been allowed to supply gas of the quality they now did. A reversion to flat-flame burners would soon indicate what he might call the various kinds of impurities that passed through in consequence of the candle power being reduced.

Mr. PRETYMAN (Parliamentary Secretary to the Board of Trade), in reply to the remarks that had been made, said he thought all the

points had been met in the Bill, the object of which was twofold. In the first place, it was a war measure, inasmuch as its present object was to do everything possible to induce gas companies to increase the supply of benzol and toluol. It was intended during the war to confine the permission to companies prepared to erect plant for producing benzol and toluol, which were greatly required. He was glad to note that the House supported the idea of the change of standard being made permanent. It was obvious that it was now out of date to insist upon the quality of gas being judged by its illuminating power. The old style of burner in an inhabited room was a thing rather to be discouraged, as a danger to health, from the impurities of the gas. The standard ought to have been altered long ago. In recent Private Bill Legislation—including the case of the Gas Light and Coke Company, whose output was about 13 per cent. of the whole output of the country—the alteration had been made; so that really they were now only carrying into effect a principle of which Parliament had already approved. It was not, however, proposed to extend the principle generally until after the war, though power was taken and it was the intention ultimately to do it. While the war lasted, they would not go beyond granting Orders to concerns that would erect the plant, as the first object was to provide for the necessities of the war. Subsidiary considerations must be deferred until later. At the same time, it was thought better to ask for general powers now. The question would certainly arise, both during and after the war, as to whether a company would derive considerable advantages from the change, and to what extent the consumer should share in these advantages. It would be seen that the Bill gave to the Departments authority to hold an inquiry before granting an Order; and by means of this inquiry, it would be possible to examine the relative advantages derivable from the change of standard. This power to go into the matter would certainly be exercised; and, as a condition of granting the Order, the Departments would be able to insist that any proper and reasonable reduction in the price of gas should be included. It had, however, to be borne in mind that it might be in the Orders which were made during the war—it would certainly be so in some instances—there would appear advantages the company would derive on account of this particular opportunity for putting down plant which would be required for national purposes during the war, but which might not always remain profitable afterwards, because in some cases there might be more, and in others less, demand for the toluol and benzol. A company might be able at the inquiry to plead that, while profit was to be derived from the plant while the war lasted, the apparatus would be of little use afterwards. Members would agree that such a possibility could not fairly be left out of account. The suggestion with regard to the keeping of separate accounts would have consideration; but, of course, in the selling of gas a company or local authority took into account all the profits made from bye-products. It seemed to him to be desirable to keep these matters as one, in order that the real ultimate cost of the gas might be arrived at, for estimating the price at which it should be sold. The primary object of a company was to supply gas; and any subsidiary operation apart from the main undertaking should be credited to the latter, and should be an element in deciding as to what price the concern was entitled to charge for gas. The matter was one he would like to go into in detail, because he did not for the moment quite appreciate the reasons for the separation of the accounts. Whenever chemicals might be produced as bye-products, the result—be it profit or loss—really affected the profits of the company as a whole, and could not be financially separated from the general statement of accounts upon which the company's right to charge was based. If, however, the Bill was passed, the Departments would have regard to the considerations which had been raised.

Sir RYLAND ADKINS inquired whether the Bill applied to companies who already had special departments for the treatment of benzol and toluol.

Mr. PRETYMAN replied that this certainly was intended; and, if necessary, the Bill should be altered accordingly.

Sir R. ADKINS said he assumed the question of the separation of the accounts would be considered after the war.

Sir W. PEARCE remarked that his contention was not that any profits made in the manufacture of bye-products should not go in the reduction of the price of gas; for this was what he desired. But these operations were becoming so extensive and complicated that, unless separate accounts were kept, it would be impossible for any undertaking or the Government to know exactly how matters stood with regard to this particular manufacture. Quite recently this necessity for the separation of accounts had come before him very much. The chemical industry had been made a controlled establishment, particularly with regard to things like sulphuric acid; and many large concerns were making the chemical substances which the Government controlled. In the case of a gas undertaking, there was no separation of accounts for the chemical operations; it had been impossible to treat them in the same way. So that they had a large number of private traders making certain similar things to those which gas companies were making; and the private traders were controlled, whereas the gas companies were out of control. It would be extremely useful to everyone concerned if a separation of accounts were insisted upon by the Government.

The Bill was then read a second time, and committed to a Committee of the Whole House.

The Committee Stage and Third Reading.

On Thursday, the Bill was considered in Committee of the Whole House—Mr. J. H. WHITLEY in the chair.

Mr. KING remarked that, on the second reading, the Bill was very warmly approved; and personally he welcomed it very much. His own criticism, and that of Sir W. Pearce (who possessed much greater experience and authority in this matter), was that they were going to give consumers of gas a cheaper article, without any assurance that a lower price would be charged; and at the same time they were encouraging gas undertakings to go in for a chemical business which they did not understand, and which might not be profitable, but very much the reverse. He then moved an amendment to substitute the word "or" for "and" at the end of paragraph (*b*) of sub-section 1. This, he said raised the point whether any Order which might be made would contain each of the provisions in paragraphs (*a*), (*b*), and (*c*). Would it, he asked, be possible to make an Order which would contain only one or two of them?

Mr. PRETYMAN said it would not. Orders would contain all three provisions.

Mr. KING thereupon withdrew this amendment. He then proceeded to move that, at the end of sub-section 2, the following words should be inserted:

> In any Order made under this section, which is made having special regard to the production of benzol and toluol, conditions may be imposed on the undertakers that they shall show by their accounts the relative cost of their production of gas and of benzol and toluol, and to preserve the rights of the consumers to a supply of gas at a cost commensurate with the cost of the production of the gas supplied.

He asked either that the Bill should be adjourned, or that an assurance should be given that, if it were allowed to go through at once, the point of view of the critics would be considered, and the Board of Trade would consult not only the gas suppliers (who, he knew, were against separate accounts, and any safeguard members would propose for the consumers), but also those who represented the consumers. No doubt, there were technical and plausible difficulties in the way of these separate accounts. The one object, of course, was to secure immediately as large a supply of chemicals as possible. Would the Parliamentary Secretary consult, not only gas suppliers and the Ministry of Munitions, but also some authoritative persons, who could speak for consumers and trades like the chemical trade? If this were promised, he would not press his amendment.

Sir W. PEARCE said war conditions justly encouraged gas-works to embark upon chemical operations; and the production of benzol and toluol was likely to continue after the war. For many years past the chemical operations of gas undertakings had increased in magnitude; and it was no use disguising the fact that war conditions were accentuating the position. One gas company he knew of were already considering whether the recovery of benzol should not be carried on for the production of aniline, and that of toluol for the production of trinitrotoluol. The time had come when there should be a separation of accounts. He asked the Board of Trade to secure by yearly audit that the cost and results of the separate gas making and chemical operations of the undertakings should be known to everybody.

Mr. PRETYMAN replied that he had gone into the matter thoroughly; and he wondered whether Mr. King understood the sliding-scale system, by which, if any profit were made on bye-products, for every pound which went to increase dividends, from four to six times as much would have to go to reduce the price of gas.

Mr. KING said he was well aware of this. What, however, he was really afraid of was the loss that might ensue on the chemical business, not the profit.

Mr. PRETYMAN remarked that the point that under the sliding-scale such a loss might result in higher prices to the gas consumer, was a good one. It might, but he did not think it was at all a likely contingency. It was not probable that a gas company would undertake secondary operations and incur a loss upon them. As to keeping separate accounts, he had also gone into this matter very carefully; and, as at present advised, he did not see how it was possible to do this. It was not practicable. In the case of farming, it was impossible to separate exactly the cost of production of any single item; and the analogy between a farm and a gas undertaking was really complete. It must be a question of valuation, and nothing else. Whether the one item would show a loss and the other a profit would depend upon what values one chose to put upon them. He would, however, undertake that, if members were able to send him any facts which would disprove this contention, they would be considered by the Board of Trade. This was not a universal Bill, in which such a change as was suggested could suitably be made.

Mr. KING pointed out that the Board of Trade insisted upon railway companies presenting accounts showing the profit and expenditure in certain directions; and he asked whether similar schedules could not be imposed upon gas undertakings.

Sir W. PEARCE said there were gas undertakings to-day where hundreds of thousands of pounds had been invested in chemical plant, and where the operations were being extended. When it came to converting benzol into nitro-benzol, and then aniline, they were really very large chemical works. The Gas Light and Coke Company, for instance, had enormous chemical plant, which was absolutely distinct from the gas undertaking; and he was surprised to hear it said that this kind of account could not be kept separate. He had heard it said that in certain instances, where chemical operations had been conducted, less money went in the reduction of the price of gas to consumers; and he asked that this growing question should be cleared up. That this should be done was in the interest of the gas companies, the general public, and the chemical industry, a certain part of which felt now that chemical operations were being conducted by gas-works which, while of no profit to the company, set up a competition which it was impossible to meet. When the extent of the chemical operations of the Gas Light and Coke Company and the South Metropolitan Gas Company was realized, he hoped the Board of Trade would come to be of his opinion, that it was full time the accounts were kept separate and the financial result known.

Sir D. FORD GODDARD pointed out that there were very few cases in which gas companies were manufacturing the chemicals which had been referred to. Only the very largest ones could do it at all; and where it was done, he thought separate accounts were kept. These processes, however, were not what the Bill was dealing with. What it related to was simply an extension of the washing of gas in such a manner that the toluol and benzol could be recovered and utilized by the nation. One could no more give a detailed account of the cost of washing gas in order to produce toluol and benzol, than for producing tar or any other things resulting from the ordinary processes of gas manufacture. Almost all gas undertakings now produced sulphate of ammonia; and they were not required to draw up separate accounts of the cost of making it. He was utterly unable to see how one could segregate these processes from the general processes of a gas-works.

The amendment was then negatived.

Mr. KING next proceeded to move the insertion, after subsection 3, of the following new subsection:

(4) In any Order made under this section, due regard shall be had to the interests of the consumers of gas for domestic and trade purposes; and a maximum price to such consumers may be fixed by the Order, which the appropriate Government Department from time to time may vary, having regard to the cost of gas production and other material circumstances.

He remarked that this amendment was directed to the same point, but in another form. In the Orders that were going to be made, was it the intention to protect the consumers directly in any way? What would happen if the measure came into force was that the company would reduce their standard of gas very much, and be charging just the same price as before. There was nothing in the Bill to protect the consumer, and particularly the poor consumer. The only protection came in when the dividend was altered; and with the increased cost of coal, labour difficulties, and so on, an increase of dividend was most unlikely.

Sir J. FORTESCUE FLANNERY remarked that the last speaker did not appear to understand the meaning, the effect, or the scope of the sliding-scale. No gas company subject to it could increase their dividend unless they reduced the price of gas; and reduction of price must necessarily be the forerunner of increased dividend. Gas companies were just as desirous as other companies of giving good dividends to their shareholders; and if the dividend were absolutely dependent, as was the case, upon the cheapness of gas, the protection of the poor consumers which had been asked for was already secured. The object of the Bill was a national one. The Government had found it necessary to ask gas companies, for national purposes, to modify their methods of manufacture in such a way as to increase the cost and reduce the possibility of profits. The gas companies responded, on the whole, most patriotically. Anything which would interfere with the gas companies in this patriotic endeavour was to be deprecated and opposed. If the amendment were carried, it would tie the hands of gas companies, and reduce their power of national service, and would inflict grave injustice on them. Every ton of coal consumed in the ordinary way was a national loss, from the point of view of explosives; while every ton carbonized for gas production was at one and the same time serving for illumination and heating, and for a national purpose in regard to explosives. He appealed to members not to do anything which might have the effect of increasing the direct consumption of coal by ordinary burning, and of reducing its use through the medium of gas.

Mr. J. F. L. BRUNNER expressed the opinion that the remarks just made were quite irrelevant to the proposal of Mr. King. They might be absolutely correct; but they had nothing to do with the amendment. It was quite obvious that, if the lighting power of the gas was reduced, the poor customers would be very badly hit. Some years ago there was a Bill before the House, for a standard of calorific value, in which the promoters proposed to supply incandescent mantles and burners free to the consumers; and he put it to the Government that, in any Order they might make under the present Bill, they should suggest this course to the gas companies. With the profits which the Bill would give them, they would be well able to afford it; and the poor consumer would then be benefited by the measure. If such provision were not made, consumers would have to go to the expense of putting in incandescent burners, because the gas supplied by the companies would not be fit for consumption in flat-flame burners.

Mr. PRETYMAN hoped that the amendment would not be pressed. Really the Bill covered the point which had been raised. In all cases where the advantage which the Bill gave to a gas company enabled the company to increase their dividend, this would automatically carry with it a decrease in the price of gas. Where, on the other hand, it did not enable a company to increase their dividend, it might have the effect of obviating a decrease of dividend, and therefore would prevent a rise in the price of gas. It was automatically to the advantage of the consumer; and where a sliding-scale was in operation, it must work to the advantage of the consumer in a larger proportion than of the gas company. Out of every pound which was gained in profit by this change, from one fifth to one-seventh would go in dividend, and the remainder towards reducing the price of gas. This seemed to be a complete answer to the point raised; but if there should be any case in which it did not apply, there was power, in making the Orders, to see that the consumer obtained fair treatment in proportion to any advantage which the gas company secured. As to Mr. Brunner's suggestion, he did not think the Government could enforce anything of the kind. He was not quite sure that flat-flame burners were used even in very poor dwellings in any large proportion. More often they were employed in underground passages, and other places where it was not thought worth while replacing the burners. In inhabited rooms, it was clearly much to the advantage of the consumers that any flat-flame burners should be replaced as soon as possible; and if the illuminating power of the gas were lowered, there would be all the more reason for substituting incandescent burners, which consumed less gas, and so meant economy to the consumer. It was just as much in the interests of the consumer as of the company that incandescent burners should be used. If they were to make it a condition that the gas company should supply these burners to dwelling-houses, they would only be giving the landlord a subsidy, thereby imposing a burden upon the gas company.

Mr. KING said that though the argument did not seem quite complete, the point of view expressed was so sympathetic that he would ask leave to withdraw his amendment. He added that he had drafted up another amendment dealing with the provision, in the case of poor persons, of incandescent burners; but he did not think he would move it.

The Bill was then reported, without amendment, read the third time, and passed.

Price of Gas at East Hull.—Owing to the continued rise in the cost of all raw materials, the Directors of the East Hull Gas Company have advanced the price of gas to 2s. 6d. per 1000 cubic feet from June 30.

ABERDARE AND ABERAMAN GAS BILL.

HOUSE OF COMMONS COMMITTEE.—Wednesday, July 5.

(*Before Sir* WILLIAM MIDDLEBROOK, *Chairman*, *Sir* STUART COATS, *Mr.* JACOBSEN, *and Mr.* BYRNE.)

This Bill, promoted by the Aberdare and Aberaman Gas Company, seeks powers to raise additional capital, to issue redeemable stock, to adopt the sliding-scale and the calorific value test, &c. It has already passed the House of Lords [see "JOURNAL," May 16, p. 345]. The only opponent again was the Aberdare Urban District Council.

Mr. HONORATUS LLOYD, K.C., Mr. G. J. TALBOT, K.C., and Mr. SZLUMPER appeared for the promoters. The Aberdare Council were represented by Mr. W. B. CLODE, K.C., and Mr. TYLDESLEY JONES.

Mr. TALBOT, on behalf of the promoters, said there were four main proposals in the Bill: (1) To convert the existing preference and ordinary stock into a uniform stock; (2) to authorize the Company to raise additional capital, both stock and loan, subject to the usual provision that no new capital shall be raised during the war, or for a period after without the consent of the Treasury; (3) to adopt the sliding-scale (the Company being at present a maximum-price concern); and (4) the substitution of the calorific value test for the illuminating power test. Almost the principal topic of controversy between the Company and the Council was the question of the sliding-scale—an important point with regard to it being the figure at which the standard price should be fixed. When the Bill was introduced in the House of Lords, the Company proposed 4s. 3d.; but this was very strenuously opposed by the Council, and ultimately the Lords Committee reduced it to 3s. 9d. The Company had very carefully considered this figure, and were advised—and, indeed, were quite clear on the experience of their own officers and experts—that they could not sell gas at the price of 3s. 9d. and pay the full dividend at present allowed as a maximum-price Company. At the same time they had come to the conclusion that they would be justified in taking the Bill with the figure of 3s. 9d. in it; and had the District Council seen their way to accept this, probably the other matters of dispute in the Bill would have been capable of adjustment. The Distriet Council, however, were not satisfied even with 3s. 9d., and were now going to ask the Committee for a much lower figure. This being so, he would call the attention of the Committee to the fact that when the Bill was before the House of Lords it was suggested by the District Council that it might meet the position from both points of view if the sliding-scale provisions were cut out of the Bill altogether, and the Company left in the old position of a maximum-price Company. Having regard to the circumstances, this point of view had been considered by the Company; and they would very much prefer to be left on the present maximum-price basis than have a lower figure than 3s. 9d. The District Council had previously intimated that they would consider the whole position if this were done. He mentioned this now because it seemed a pity that the Committee should be troubled with a long discussion upon what should be the proper standard price—time which might in the end be thrown away, because the Company regarded 3s. 9d. as the lowest possible figure that they could accept. Therefore, he offered to the District Council that clause 31, dealing with the sliding-scale, should be struck out, and the Company left in the position of a maximum-price concern. He did not know whether Counsel for the opponent wished to say anything upon this.

Mr. CLODE, for the Aberdare District Council, said that his clients felt from the very beginning that it was a most difficult and invidious position to place any Committee in to ask it to fix a standard price in such abnormal times, because there was a danger that the price fixed might have no regard to the position of the future, seeing that nobody could foretell what the future after the war was going to be. Therefore, they strongly and hotly resisted the proposal of the Company to have what they considered a high standard price fixed in the present abnormal times to govern the Company for the next fifteen years or so, in view of the fact that new capital to the extent of £40,000 was being granted.

Mr. TALBOT said the amount of capital in the Bill only carried the Company on for ten years.

Mr. CLODE replied that, whatever the time was, the Council felt it was too long a period over which to fix a standard price in existing circumstances. He had intended to ask the Committee to put it at 3s. But even this might be the wrong figure; and the suggestion that the clause should be struck out of the Bill, almost, if not entirely, disposed of the opposition of the Council. Certainly this point was the principal ground of contest, and he was not averse to the Company proceeding with their Bill on the condition that they were allowed the £40,000 additional capital in it, that the sliding-scale clause was eliminated, and that, as to public lighting, the Council should be granted an allowance of 3d. per 1000 cubic feet on the price charged to the ordinary consumers for lighting—thus placing the Council practically in the same position that they were in before the Bill passed the House of Lords.

Mr. TALBOT said he was not at the moment actually in the position to definitely settle anything, but suggested that if the Committee would grant a short adjournment they might be saved further trouble in the matter. As to the public lighting question, he presumed Mr. Clode desired the 3d. allowance, as compared with the ordinary consumer.

Mr. CLODE: Yes.

Mr. TALBOT: Not the power consumer and large consumer.

There was a difference of opinion upon this, and the point was left over for negotiation.

After an adjournment,

Mr. TALBOT said the parties were entirely agreed on everything of substance. The terms arrived at were that the new capital which the Company were entitled to raise by way of stock and borrowing should be £50,000, and not £40,000 contingent upon the other terms agreed. The price for public lighting was practically agreed; but on any point in dispute with regard to this the parties had consented to take the Chairman's ruling. The sliding-scale clause was to go out of the Bill; a new testing-station away from the works, which was one of the

matters the District Council asked for in the House of Lords, was to be provided at the expense of the Council; and the calorific testing clauses were to stand. There was also to be a special clause for the protection of the District Council in respect of their roads, as to some matters upon which they did not feel they were sufficiently protected by the ordinary Statutes; and, lastly, the provisions in the Bill with regard to the conversion of capital were to come out. These were the skeleton terms to which the parties had agreed; and he asked the Committee to sanction them.

In answer to the CHAIRMAN, Mr. Clode said that the £50,000 was entirely new capital, and took the place of the £40,000 at present allowed by the Bill.

The preamble of the Bill was then formally proved, and the Committee adjourned.

Thursday, July 6.

The CHAIRMAN this morning formally examined the clauses. With regard to public lighting, it is provided that the Urban District Council are to be charged a price not less than 8 per cent. below the net price charged to ordinary consumers for lighting purposes, or 2 per cent. below the net price to any other consumer for lighting purposes. For power purposes, the charge is not to exceed the lowest price charged by the Company to any private consumer for power purposes.

As a consequence of the elimination of the sliding-scale, a new clause has been added limiting the profits on the additional capital to be raised under the Act to 7 per cent. on the ordinary shares and 6 per cent. on the preference capital; the existing 10 per cent. on the original capital, of course, remaining.

Provision is made for the testing-place away from the works at the expense of the Council; and a new clause imposes upon the Company the obligation to supply, and fix free of charge should any consumer require it, a sufficient number of flat-flame burners suitable for the consumption of gas of the calorific value to be prescribed in the Act in substitution for the burners, not incandescent burners, now in use. Notice of the provisions of this section of the Act is to be given on each demand note of the Company during a period of two years—this being the period in which the Company are to be obliged to supply new burners.

An addition has been made to the clauses dealing with redeemable stock—prohibiting the Company from redeeming out of revenue any debenture or preference shares or stock created under the Act.

For the rest, modifications in the clauses have been made to give effect to the agreement mentioned by Mr. Talbot on Wednesday.

The Bill was ordered to be reported for third reading.

HORNSEY GAS BILL.

This Bill was, last Thursday, considered by the Unopposed Bills Committee of the House of Commons, and was ordered to be reported for third reading.

Mr. SEAGAR BERRY (Messrs. Sherwood and Co., Parliamentary Agents) said the main object of the Bill was to define the boundary between the areas of the Hornsey Gas Company and the Gas Light and Coke Company. There had been a great deal of doubt as to what was the real boundary line between the two areas; and the Companies concerned had now come to an agreement on the matter. The only other point to which he had to call attention was clause 7, which gave power to manufacture residuals. Under the earlier Orders of the Hornsey Company there was inserted, at the instance of the Local Authority, a prohibition on the manufacture of residuals; but now, with the assent of the Local Authority, the Company were asking for powers to manufacture residuals on a small portion only of their gas lands, and there was no objection by anybody. The rest of the Bill merely brought the Company up-to-date in regard to general gas legislation by the introduction of Model Clauses on various matters of detail.

The CHAIRMAN called attention to the fact that the calorific value clause was in the Bill. Was this affected by the Government Bill now before the House?

Mr. BERRY said the clause in the Company's Bill merely substituted the calorific value test for the illuminating power test which the Company had. The Company itself had not proposed to alter the illuminating power test; but the Local Authority had asked for it, and, there being no objection on the part of the Company, the request had been granted. If the Public Bill passed, the Company would, without the clause in the Bill, have the right to apply for similar powers. The clause provided for 540 B.Th.U., with the margin of 7½ per cent., which was the form now adopted in the Model Bill.

Mr. MOON, K.C. (Speaker's Counsel), drew attention to clause 14, which he said was something new in the way of gas legislation, and ought to be explained.

Mr. BERRY said the clause authorized the Company to transfer to capital account a sum of £25,000 of accumulated funds; but when so transferred, the amount was not to earn any dividend.

In answer to questions from the Committee, Mr. BERRY said the £25,000 represented accumulated dividends which the Company were entitled to have distributed years ago, and was in excess of the reserve fund. The position was that, having reduced the price in the past, the Company were entitled to have distributed a higher rate of dividend; but they had not done so, and the money had been kept in hand. In other words, the consumers had had their share of the bargain, while the shareholders had not had theirs.

The CHAIRMAN suggested that this had had the effect of keeping up the price of gas.

Mr. MOON, however, said this was hardly so, as the Company were legally entitled to have distributed this sum—it being the result of their having reduced the price of gas and so obtained the right to distribute a higher rate of dividend.

The CHAIRMAN said it really was a hidden reserve.

Mr. BERRY replied that it was hardly that, as it was not hidden in he accounts. It was undivided profits.

In answer to further questions, Mr. BERRY said the amount was being used at present as working capital. Had it not existed, it would have been necessary to have had a loan from the bankers or issued new capital, which at present, of course, would be almost impossible, owing to the necessity for obtaining the consent of the Treasury.

The CHAIRMAN said what he could not quite fathom was the motive of the Company in wanting to do this.

Mr. BERRY said the Company wanted to make it clear in the accounts that this sum had been put to capital account.

The CHAIRMAN said he therefore understood that the position was that whereas the shareholders had agreed to the money being retained for the purpose of the business, the Company wished to have it made statutory, in case some shareholder might say that it was not capital and ought to be divided.

Mr. BERRY said that was the position. The proposal had been scrutinized by the Local Authorities, and there was no objection.

The COMMITTEE sanctioned the clause.

With regard to clause 7, dealing with residual products, this, Mr. BERRY said, was more restrictive than the Model Bill clause, as the latter allowed a gas undertaking to deal with one-third more than the residuals coming from their own works. In this case, the Company were restricted to manufacture only the residual products which they got from their own gas manufacture, with a daily penalty if it were not complied with.

This clause was also sanctioned; and the preamble of the Bill was formally proved.

MISCELLANEOUS NEWS.

BIRKENHEAD GAS UNDERTAKING.

Mr. W. Doig Gibb's Report.

In the course of a report which he has submitted on the Birkenhead Corporation gas undertaking, Mr. W. Doig Gibb states that at this abnormal time it is not expedient to do any new work which can be postponed; but he thinks the Gas Committee would be well advised to get a report from the Engineer as to what expenditure would be absolutely necessary to bring some of the new and completed plant at the works into operation. A large expenditure is lying idle, much of which could be utilized at comparatively small cost; and this would quickly pay a good percentage on the increased outlay on cheaper working and in greater security. He strongly advises that the whole scheme should be completed as soon as circumstances may allow it. Better mess-room and lavatory accommodation is required; and there is need of better fitting shops and tools.

The report proceeds: "Considerable economies could be effected by a reduction in the illuminating power of the gas supplied. The standard which is now being asked for by most gas undertakings is a calorific one of 500 B.Th.U. gross, with no illuminating power standard. This means an illuminating power of about 14 candles when tested on the No. 2 burner; and it is, by general consent, the cheapest gas for the consumer. The extra cost of maintaining the gas at its present standard is out of proportion to the value the consumers receive. At the proper time, it would be expedient to carefully consider the point."

COLCHESTER GAS BILL.

The Town Council and Gas Company Agree.

As the result of concessions upon either side, a mutual agreement has been arrived at between the Colchester Town Council and the Gas Company, on the subject of the Bill which the Company are promoting in Parliament. The Special Committee have reported on the matter; and, according to a statement made in the Council last week, the points considered most important were four in number. The first was the question of charges for street lighting. At present the Council were paying 2s. 9d. per 1000 cubic feet, against 3s. formerly; and it was felt that some further concession should be made. In the end, the Company agreed that, so long as the Corporation consumed 9 million cubic feet of gas, they could have it at 2s. 6d., instead of 2s. 9d. per 1000 feet; and so long as they took 5 million feet only, they would get it at the present price.

The second important point related to the standard price of gas. The Corporation worked hard to obtain a reduction from 3s. 3d. (the price passed by the House of Lords Committee); but it was pointed out that already 3s. 3d. was the lowest price paid by any Essex town, and that in the Directors' view 3s. 6d. would have been a fairer price than 3s. 3d.

On the question of the reduction of capital, the Directors saw their way to meet the Council to the extent of another £20,000; so that altogether the reduction of capital amounted to £48,000, as compared with the amount mentioned in the original Bill.

Another important point was the difference between the amount paid by ordinary consumers and that paid through prepayment gas-meters. After a long discussion, the Company agreed to provide, on request, an incandescent burner to each of the prepayment consumers, of whom there were 6000.

Mr. SANDERS expressed satisfaction at the settlement with the Gas Company. The whole point, to his mind, depended on the question of the standard price of gas. He thought the expenditure of £800 had been amply justified by the results.

Mr. LUCKING agreed, adding that the thanks of the Council and the ratepayers were due to Councillor Wallace, who had from first to last taken the deepest interest in the matter.

Mr. WRIGHT endorsed Mr. Lucking's commendation of Councillor Wallace and the Special Gas Committee.

STOKE-ON-TRENT GAS DEPARTMENT.

A Gratifying Report.

The annual report of the Gas Committee, covering the year ended March 31, was presented at the last meeting of the Stoke-on-Trent County Borough Council. It showed that a loss of £6779 for the previous year has been turned into a net profit of £4408. In fact, as a local paper remarks, the report was of a gratifying character, and greatly to the credit of the Committee and Mr. L. J. Langford, the Engineer and Manager.

It was presented by the Chairman of the Committee (Alderman Mitchell), who remarked that at the outset they were confronted with increased charges of 33 per cent. for coal, and were reluctantly compelled to raise the price of gas 6d. per 1000 cubic feet from July last. It was but a short number of years since coal could be purchased at half the price they were to-day paying. The gross profit was £23,256, and the net profit £4408. The net loss for the preceding year was £6779. Receipts from the sale of gas, including public lighting charges, were £71,142, against £61,566, being an increase of £9576. On the other hand, the cost of coal was £48,335, as against £37,548, an increase of £10,787. Thus the increased price of gas failed to make good the increased cost of coal by £1211. The revenue from residuals and fittings amounted to £32,638, against £26,490, showing an increase of £6148. The total expenditure other than coal amounted to £32,188, against £39,033, showing a decrease of £6845, or 17·5 per cent. From this the Council would see that "economy" had been the watchword of the Committee. The total quantity of gas made was 696,966,000 cubic feet, of which 626,783,000 cubic feet were sold. The previous year's sale was 649,516,000 cubic feet; so that for the past year the demand was reduced by 22,733,000 cubic feet, or 3·5 per cent.

Burslem Works.—The gross profit was £7011, against £4027 for the preceding year, showing an increase of £2984. The interest and sinking fund charges were £5084, leaving a net profit of £1927, compared with a loss of £1140. The expenditure was £26,332, against £24,925, an increase of £1407. This was a very low increase, especially when coal alone cost £3357 more than the year before. The total revenue was £33,343, against £28,952, or an increase of £4391. The increased revenue from gas was £2756, and £1635 was from residuals and fittings. The decrease in the quantity of gas sold was 9,231,600 cubic feet, or 4·31 per cent.

Stoke Works.—The gross profit at the Stoke works amounted to £4295, as compared with £1292. After payment of interest and sinking fund charges of £4205, a net profit remained of £90, as against a loss the preceding year of £2815. The total expenditure was £18,219, and the previous year £18,834; so that, despite increased coal costs of £1934, there was still a reduction of £615. The revenue was £22,514, against £20,126, or an increase of £2388. The increased revenue from gas was £1764, and from residuals £624. The last item was capable of improvement; and the Committee were hopeful that steps already taken in conserving ammonia products, &c., would bring greatly improved results. Of the four undertakings, this works had been the most heavily hit as regards reduction in gas sold. Some 9,362,000 cubic feet less was sent out than in the previous year, or 6·62 per cent.

Fenton Works.—Fenton was the only works which more than maintained the output of gas. Despite the suspension of public illumination and the adoption of the Lighting Order, there was an increase in the quantity of gas sold of 1,774,000 cubic feet, or 1·51 per cent. The general working results, too, were exceptionally good. When coal contracts were entered into, Fenton was fortunate in having some thousands of tons to come in on an old contract; and the Committee effected a deal which made the average price per ton for the year 2s. 2d. less than that paid for the supplies for the Stoke works. The gross profit for the year was £5672, or £3573 in excess of the previous year; and the net profit was £2596, against a loss of £778. The total revenue was £19,454, against £15,815, an increase of £3639; and the expenditure £13,781, against £13,716, a decrease of £65.

Longton Works.—The gross profits amounted to £6278, against £4056, showing an increase of £2222. The net loss was £203, against last year's loss of £2046. Longton had to meet considerably greater capital charges than obtained at the other works; the comparison being as follows, per 1000 cubic feet sold: Burslem, 5·95d.; Stoke, 7·85d.; Fenton, 6·23d.; and Longton, 9·12d. This was the main reason for the balance being on the wrong side. At the same time, the revenue account had borne exceptional expenditure to the extent of £800. The total revenue was £28,468, as compared with £23,162, an increase of £5306; and the expenditure, £22,190, against £19,106, an increase of £3084. The decrease in the consumption of gas was 5,914,000 cubic feet, or 3·34 per cent. This decrease dated from the time of the lighting restrictions. Until then the consumption had been well maintained.

The make of gas per ton of coal carbonized at the different works was as follows: Burslem, 12,413 cubic feet; Stoke, 13,176 feet; Fenton, 13,055 feet; Longton, 13,295 feet.

OLDBURY GAS UNDERTAKING.

At a Meeting of the Oldbury District Council last Friday—Mr. J. Pound presiding—the Gas Engineer (Mr. Charles H. Carder) submitted the accounts for the financial year ended March 31 last.

He stated that it had been a period of considerable stress and difficulty. In view of the rapid development of munition works in the district, and to ensure an adequate supply of gas, a contract was placed early in the year with Messrs. Humphreys and Glasgow for an additional carburetted water-gas plant of 600,000 cubic feet per day capacity. This had been completed and taken over, and was working very

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satisfactorily. The gas mains and plant in the Whiteheath district had been taken over by the Rowley Regis and Blackheath Gas Company at an agreed price. The reduction in the demand for gas, owing to the restricted lighting, had not so far been equalled by the greater requirements for works purposes, although the latter demand was increasing. The Summer Time Act would cause a considerable further decrease in the demand for gas for domestic and shop consumption. The unprecedented and abnormal increases in the cost of all supplies, and particularly in that of coal, necessitated a considerable increase in the price of gas in the early part of the year. The increased revenue thus obtained had been more than absorbed by the much higher costs and by increased wages and war allowances. To date 23 employees of the Gas Department had left to join the Forces or for the direct manufacture of munitions. Allowances were being made to the dependants of those in the Army and Navy. The withdrawal and replacement of men had been a source of considerable anxiety. A substantial allowance had been made to the Public Lighting Committee in consideration of the reduction of street lighting. The market for residuals had considerably improved during the past year; the net revenue from this source being equal to 13s. 2·2d. per ton of coal carbonized, as compared with 8s. 6·6d. for the previous year. After making adequate provision for the deterioration of stocks, &c., there remained a gross profit of £6545, and a net profit of £3277, compared with a net loss last year of £1842.

Mr. E. W. Jackson (the Chairman of the Gas Committee), in submitting the report, proposed a resolution congratulating the Engineer upon the excellent result of the year's working, and said the undertaking was in a far happier position now than twelve months ago. Last year they finished up with a net loss on working of £1842. They then had an overdraft at the bank of £2693; while they had a loan of £6200 on the new holder which had to be repaid in five years. They were also faced with a considerable increase in the price of coal—6s. per ton. One of the most serious mistakes they had made in connection with the undertaking was to reduce the price of gas when the cost of coal went up. Now, however, thanks to the efforts of their new Manager, they were able this year to show a net profit of £3277, the overdraft had been reduced to £1064, and the time for the new holder loan had been extended to ten years. The increased revenue due to the advance in the price of gas for the year was £3094; but it had also cost £2907 more, which left a profit made on the new charges of £187. The main profit was in connection with the sale of coke, liquor, and the saving by the Manager of 550 tons of coal, which would be equivalent to £600. They had in the coming year to meet a further decrease in the price of tar of £200, and an increase in the price of coal of 1s. per ton. There was also £1000 to be paid for the new holder, and the overdraft to be met. The insurance of the gas-works had been increased from £2195 to £20,000; and they had insured the works against damage by enemy aircraft. The arrangement with surrounding authorities for the coupling of the gas-mains in the event of the supply being cut off would, he felt, be very advantageous to Oldbury. There was an increased revenue of £295 from slot-meter consumers, of £1723 from ordinary consumers, and £1255 from power consumers. On the whole, the financial position was most satisfactory, and the Manager was entitled to their thanks and congratulations.

Mr. C. Tomlinson, in seconding the resolution, said Mr. Carder had made many improvements while he had been with them; and he hoped in a short time he would have some consideration.

Mr. W. T. Davies urged that the price of gas for motive power was too high.

Mr. Jackson said whenever it was possible the Committee would be pleased to reduce the charges all round.

The accounts and the resolution of congratulation to the Manager were approved.

Mr. Carder's working statement shows that the total quantity of gas made was 157,958,000 cubic feet, of which 8 per cent. was carburetted water gas. The make of gas per ton of coal carbonized was 12,639 cubic feet. The leakage and unaccounted-for gas amounted to 9·22 per cent.; the total quantity sent out from the works showing a decrease of 8·08 per cent. when compared with the preceding year.

THE GAS INDUSTRY IN THE UNITED STATES.

Official Returns for the Year 1914.

The Bureau of the Census Department of Commerce have issued a preliminary report dealing with the returns received from 1284 gas undertakings, of which 427 manufacture carburetted water gas, 274 straight coal gas, 156 mixed gas, 150 oil gas, 165 acetylene, and of the remaining 112, the principal product was gasolene gas. The oil-gas plants included 61 on the Pintsch and 4 on the Blau system; and the 165 acetylene plants included 36 that distributed the gas in containers.

The total make of gas was 203,730 million cubic feet, valued at approximately $175,000,000. It comprised 10,506,000,000 cubic feet of straight coal gas, valued at $10,726,514; 90,018,000,000 cubic feet of carburetted water gas, valued at $74,516,534; 86,281,000,000 cubic feet of mixed gas, valued at $72,012,021; 16,602,000,000 cubic feet of oil gas, valued at $15,044,509; 138,000,000 cubic feet of acetylene, valued at $2,511,634; and 181,000,000 cubic feet of "other gas" (chiefly made from gasolene), valued at $254,718. The sales of residual products included 114,000,000 bushels of coke, valued at $8,719,910; 126,000,000 gallons of tar, valued at $3,252,756; ammoniacal liquor, sulphate, and hydrocarbons, valued at $1,405,540; and also other products, consisting largely of gas purchased from coke-oven plants, for distribution in the usual course, to the extent of $21,000,000. The

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receipts from sales and from rent of stoves and appliances were about $11,000,000.

As compared with the similar returns for 1909, there is an increase to the extent of 32 per cent. on the total values of gas and products, and of 35 per cent. on the quantity of gas manufactured. The principal advance is on mixed gas, which has more than doubled. Oil gas has gone up 91 per cent., and acetylene 448 per cent. Carburetted water gas has increased by 11 per cent.; but coal gas has decreased to the extent of 47 per cent., and "other gas" 16 per cent. The advance in oil gas is chiefly due to increased production in the Pacific Coast states; and the large growth of the acetylene business is mainly due to the distribution of this gas in containers. The decrease on straight coal gas is accounted for by the fact that many companies have changed from straight to mixed or to carburetted water gas.

The figures above quoted are exclusive of a large quantity of coke-oven gas used for ordinary supply, of which the gas purchased is a portion. The bye-products produced by coke-ovens included 61,364,000,000 cubic feet of gas, valued at $6,000,000 (only about 10 c. per 1000 cubic feet); 110,000,000 gallons of tar, valued at $2,867,274; ammonia sulphate, or its equivalent, 171,000,000 lbs., valued at $4,696,500; ammoniacal liquor, 6,000,000 gallons, valued at $608,497; and other products, $997,107. As compared with 1909, the sale of gas has increased four-fold; but the residual products have only advanced 40 per cent., showing that a larger quantity of gas is now disposed of outside the works than was formerly the case.

The consumption of coal by the gas undertakings amounted to 6,116,672 tons, and the cost was $20,872,517; 716,619,357 gallons of oil were consumed, costing $24,934,184; 964,851 tons of coke, costing $4,706,682; 31,749,491 lbs. of calcium carbide, costing $778,537; and 28,371,000,000 cubic feet of gas purchased at a cost of $8,883,016. In addition, fuel was purchased for boilers, &c., to the value of $3,784,911. Of the residual products used on the works where they were made, there were consumed in connection with manufacture, 65,000,000 bushels of coke, 27,000,000 gallons of tar, 1,121,000,000 cubic feet of gas, and 99,238 gallons of benzol. The mileage of mains was 58,727 (increase, 30 per cent.), 5,168,924 gas cookers and heaters were reported as in actual use (increase, 43 per cent.).

These figures indicate rapid progress in the sales of gas during the last five years, and are a striking commentary on the activity in the commercial and selling departments, of which the contents of our American contemporaries have afforded prominent evidence for some time past. The average value of the total gas sold is 86 c. per 1000 cubic feet. The coal gas is rated at 102 c., the carburetted water-gas (mixed gas) at 83 c., and the oil gas at 93 c. The acetylene and the "other" gases, valued at $18·2 and at 140 c. respectively serve to inflate the value of the total. Coke averages nearly 8 c. per bushel, and tar about 2½ c. per gallon. In respect to the first cost of manufacturing materials, American gas engineers are at a great advantage as compared with their British colleagues. The average cost of coal is $3·42, and of oil 3½ c. per gallon.

TRIBUNALS AND EXEMPTION APPLICATIONS.

An employee of the British Gaslight Company, who appealed at the Hull Tribunal for exemption from military service, described himself as a gas-meter fixer; but a representative of the Company said it was incorrect to state that he was doing the work of a meter-fixer. He was only sent out with a properly qualified man, to assist in the work. Applicant replied that he had done fixing work, but without the Company's knowledge. Captain Boyd (the Military Representative) said he had approached Mr. John Young, the local Manager for the Company, urging him to spare as many men as possible for enlistment; and Mr. Young had promised to do so. As a public-utility service, they could not, however, interfere with the employees in any way. Applicant, a married man, complained that his case had not been considered by the Company as against that of two single young men whose services were being retained. He suggested that he should be sent to a munition factory; and this course was adopted.

The Chester Water Company appealed for a young man, aged 23, married, and described as cashier, collector, and clerk. The ground of the application was "national interest," and absolute exemption was asked for. He was stated to be the only man left in the office. Out of a staff of four, three were serving with the army; their places having been taken by women. In addition, it was said, 50 per cent. of the Company's workmen had enlisted; and with others waiting to be called, the total would be 85 per cent. The Mayor remarked that the Company had done very well. Three months' exemption was granted, on condition that the official joined the Volunteers; but the Mayor said they did not promise to renew the exemption.

At Guiseley, the local Water Company have secured exemption till Sept. 30 for their Secretary and Manager, who, they held, was absolutely indispensable.

ANOTHER WAR PROSPECTUS.

[From the "Financial News," July 8.]

Among the war prospectuses apparently issued early in 1915 was that of the United Gas-Works Development Company, Limited. That enterprise has a capital of £20,000 in 20,000 shares. The prospectus appears to have been concerned with an issue of debentures, though this is not explicitly stated. It must, however, have been associated with an issue of some kind, since it bears at its head the words "This issue has been sanctioned by the Treasury," together with the rest of the usual formula with which the public has by now become quite familiar. To the prospectus there was appended a balance-sheet, made up to Oct. 31, 1914, and an auditors' certificate signed by Messrs. Chadwick and Co., and bearing date Dec. 22, 1914.

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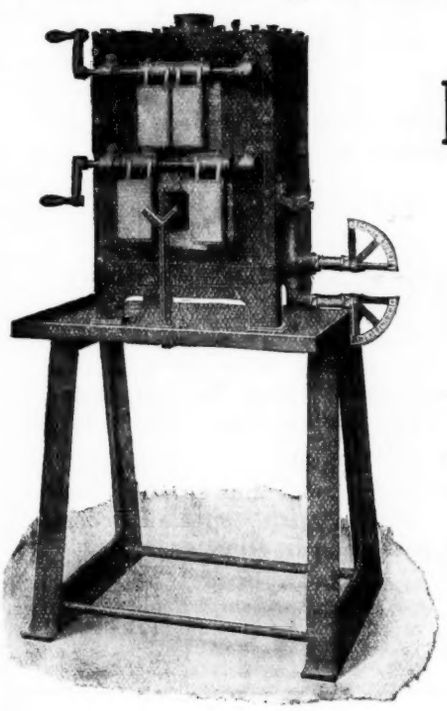

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Our New List (No. 14), sent Post Free, describes this and many other new Furnaces.

JOHN WRIGHT & CO., Essex Works, BIRMINGHAM.

that a receiver had been appointed, add that the receiver's investigations disclose various regrettable facts, "with the result that practically the whole of the capital of the Company has been lost." One of the consequences, according to Messrs. Taunton and Co., is that there are now no assets whatever for distribution among the debenture-holders, "except some partly-paid shares in a company known as the Abercorn Hotels (England), Limited. These shares are 5s. each, with 3s. 6d. paid thereon." Messrs. Taunton and Co. state that holders of debentures are entitled to a transfer of certain of these shares, free of cost, not in exchange for, but in addition to, such benefits as may accrue to them from their debenture rights. The Solicitors add that the Abercorn Hotels (England), Limited, appears to be doing well, and they anticipate a regular half-yearly dividend at the rate of 10 per cent. per annum. They strongly advise holders of debentures to take up these partly-paid shares. It will be seen, however, that there is a liability of 1s. 6d. per share to be faced. Of this, 6d. is already called up, and further sixpences will be called on Aug. 1 and Sept. 1. Hotel business is not a particularly glowing enterprise in these days; and to our mind holders of United Gas debentures would do well to consider seriously whether it is worth their while to pay 1s. 6d. apiece for shares of such a speculative type.

The main moral of the whole business, however, is the sanction alleged to have been given by the Treasury to the United Gas-Works Development issue. What with ranking Mr. Harry John Lawson and his enterprises as of first-class national importance, while at the same time pushing Barclay's Bank aside as a concern of no consequence and no public utility, and apparently in sanctioning an issue by a gas company which is already in the hands of a receiver, the Treasury New Issues Committee is doing brilliant work. It is said in the City that the distinguished men who nominally form the Committee take very little real share in its deliberations. The actual decisions, so report says, are those of clerks and understrappers. If that is so, their erratic and incomprehensible character will be accounted for. On no other hypothesis is it possible to understand the fantastic decisions of this tribunal.

DYE PRODUCTION IN JAPAN.

An extract from the "United States Commercial Reporter" is given by the "Chemical Trade Journal," stating that all the bye-products of the Japanese Government Iron-Works, the Mitsui Mining Company, the Mitsu Bishi Company, the Tokio Gas Company, the Osaka Gas Company, and other factories, are being fully used. The supply of coal tar now exceeds 60,000 tons; and in its distillation many big commercial interests are engaged. The foremost of these is the Nippon Dyestuff Company, which has a capital of 8,000,000 yen (£800,000). It profits from Government protection under the law for the encouragement of chemical and dye-stuff industries, although the concern is still far from actually being in operation.

Gas companies in Osaka and Tokio have also taken up the manufacture as a subsidiary branch, as they have a good supply of coal tar at their disposal. Aniline salt and induline are already marketed by the Tokio Gas Company. The Mitsui Mining Company have succeeded in producing a variety of dyes from the coal tar produced by their works at Miike. A month hence the Company hope to extend the list of their products so as to include additional derivatives of benzol, carbolic acid, salicylic acid, and picric acid. There are also many minor enterprises engaged in this branch—including the Osaka Chemical Industry Company and the Kobe Seikojo. These produce several artificial dye-stuffs, and contribute much to the rapid development of the important new industry.

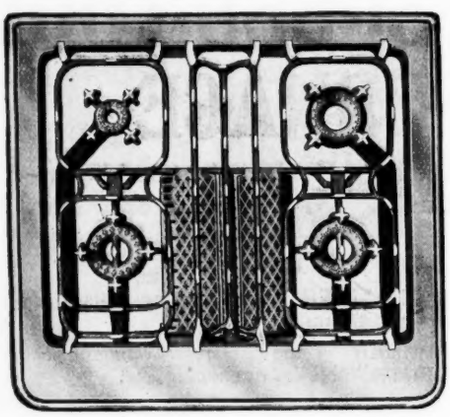
There are still many difficulties to be overcome. In the first place the scarcity of auxiliary materials hampers the efforts of manufacturers. Sulphuric acid is obtainable, but there is said to be no stock of oleum in the country. Caustic soda and soda ash are also scarce. Unless these materials can be more freely supplied, the development of the dye-stuff industry will be seriously retarded. In the second place dye-stuff producers are confronted with a grave problem to find a market for the bye-products. The local demand is small. Lastly, there is a pronounced technical difficulty yet to be overcome. As the enterprises are developed, the equipment necessarily becomes more and more elaborate, and experts' difficulties in handling the problems are all the more enhanced.

NOTES FROM SCOTLAND.

Dundee Gas Accounts.—The accounts of the Dundee Gas Commissioners for the period ended May 15 last show that the quantity of coal carbonized was 107,355 tons, and of pitch 749 tons. There were also used 91,820 gallons of gas oil, and 2200 gallons of tar oil. The make of coal gas is given [with a note that, owing to a defect in the station meter, statistics as to the make of gas cannot be relied on] as 1,136,842,000 cubic feet, and of carburetted water gas as 32,887,000 feet. The make of gas per ton of coal carbonized was 10,533 cubic feet; and the production of sulphate of ammonia amounted to 28·58 lbs. per ton of coal. The average cost of production per 1000 cubic feet for both coal gas and carburetted water gas was 1s. 9·03d.; the carbonizing charges for coal only being 0·87d. per 1000 cubic feet. The total number of consumers at May 15 was 51,546, which was an increase of 116 on the year. With a price of gas of 2s. 9d. per 1000 cubic feet (subject to a discount of 5 per cent.), the total income was £207,085, and the expenditure £153,158, leaving a balance of £53,926 to meet annuities, interest, sinking fund, and contingent fund charges. The result was a profit of £16,656, which compares with a loss of £10,037 a year ago.

Rise in Price at Kirkcaldy.—Estimates for the ensuing year were submitted at a recent meeting of the Kirkcaldy Gas Committee. It was shown that during last year the sale of gas had fallen off by about

60 % Increased Efficiency



Plan of Hotplate.

is the fine result achieved by the new Hotplate of

RICHMOND'S

"Economic" Cooker.

The Hotplate bars are removed from the vicinity of the Burners, and the kettle or other vessel is supported entirely by the Burner itself (see Hotplate plan).

The Burners are of an entirely new pattern, fitted with specially constructed gas and air adjuster.

A London Gas Engineer writes:—"*I have always felt that the ordinary Hotplate Burners left a lot to be desired. The results you have attained show how very thoroughly you have tackled the matter, and I wish you every success with your new Cooker.*"

THE RICHMOND GAS STOVE & METER CO., Ltd.,

Academy Street, Warrington. 132, Queen Victoria Street, E.C.

10 per cent.; and a decision was come to that the price should be increased by 4d. per 1000 cubic feet, making the charge 4s. 9d.

Price of Gas at North Berwick.—The North Berwick Gas Company have decided to increase the price of gas from 4s. 7d. to 5s. per 1000 cubic feet.

Pittenween Gas Company.—The Pittenween Gas Company have determined to continue the price of gas at 5s. per 1000 cubic feet. A dividend is declared of 5 per cent., free of income-tax.

Electricity Deficiency at Edinburgh.—At a meeting of the Edinburgh Town Council Electric Lighting Committee, it was reported that the deficiency on the account for the year was £8075. This amount will have to be made good from the reserve fund, which is almost at its maximum.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *July* 10.

There is no great change to report in the London tar products market, pitch remaining about 20s. per ton in bulk, *ex* makers' works. All other products remain the same; creosote being 4d. to 4⅛d., and solvent naphtha 2s. to 2s. 1d. net per gallon.

There has been no remarkable change in the position of sulphate of ammonia.

Tar Products in the Provinces.

July 10.

There is practically no alteration in the value of tar products. Business in pitch is still very quiet. Reasonable prices are reported to have been accepted for solvent naphtha. Heavy naphtha is in fair demand. Creosote remains very weak.

The average values of gas-works products during the past week were: Gas-works coal tar, 15s. to 19s. Pitch, East Coast, 15s. to 15s. 6d. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent. naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6¾d. to 7d. Solvent naphtha, naked, North, 1s. 9d. to 1s. 10d. Heavy naphtha, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¼d. to 2½d. Heavy oils, in bulk, 3⅝d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *July* 8.

The strength of the market has been well maintained during the past week, and still higher prices have been paid for both near and distant delivery. The requirements have again been largely for munition works in this country, but some neutral buyers have also shown considerable interest. The nearest prompt values at the close are £17 5s. per ton f.o.b. Hull, £17 10s. f.o.b. Liverpool, and £17 12s. 6d. f.o.b. Leith. Manufacturers are rather disinclined to sell for future delivery, but transactions have been reported at £17 12s. 6d. per ton f.o.b. Liverpool for July-December, and at £17 15s. f.o.b. Leith for July, 1916, to June, 1917, in equal monthly quantities.

Nitrate of Soda.

This market is unchanged, and holders on spot still require 18s. per cwt. for ordinary quality, and 18s. 9d. for refined.

Sulphate of Ammonia.

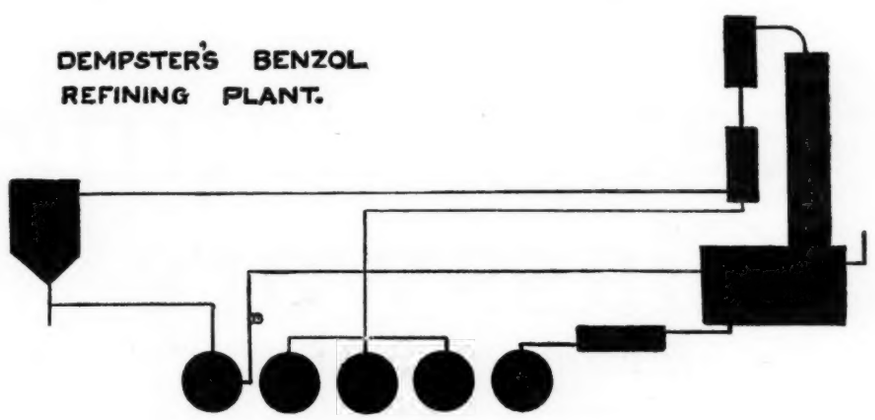
From another source it is reported that there is practically no alteration in the values of this article. Outside London makes are £15 15s. to £15 17s. 6d.; Hull, £16 12s. 6d.; Liverpool, £16 15s. to £16 17s. 6d.; Leith, £16 17s. 6d. to £17; Middlesbrough, £16 15s.

The price of outside London makes quoted last week should have been £15 15s., and not £16 15s.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is steady, and prices, on the whole, are well maintained. Steamers have arrived more regularly, and thus there are heavier exports; but the possibility of the extension of the "limitation" of prices to other parts than France tends to postpone buying forward. In the steam coal trade, there is some irregularity in prices, but best Northumbrians are from 50s. to 53s. per ton f.o.b., according to the time of delivery. Second-class steams are about 46s. to 47s. 6d. per ton; and steam smalls are from 27s. 6d. to 32s., according to the class. The supply of coal is fairly full, and merchants who have tonnage can at times obtain fuel at slightly less than the prices quoted, especially for delivery a little forward. Thus there is more bargaining for cargoes, and prices are in some degree nominal. In the gas coal trade, the demand must now be expected to improve for home needs. The prices are steady. For best Durham gas coal, the quotation is from 35s. 6d. to 36s. per ton f.o.b.; second-class kinds are near 34s. to 34s. 6d. per ton; and for "Wear Specials," about 37s. 6d. to 38s. 6d. per ton is near the f.o.b. price. Durham coals are steadied by a full demand, especially for coking. This has its effect on the gas coal trade, though, as far as the foreign needs are concerned, the expectation that the "limitation" prices may be extended checks buying just now. Little is doing in contracts at the present moment; but deliveries are fair. Freights are easier, though gas coal, Tyne to London, is still about 12s.; while to Genoa, for the same cargo, the freight has eased-down



DEMPSTER'S BENZOL REFINING STILLS

AT THE PRESENT TIME ARE PRODUCING

100,000 GALLONS

OF REFINED PRODUCTS PER DAY.

R. & J. DEMPSTER, LTD. MANCHESTER.

to about 85s.—possibly with the expectation that controlled freights may be arranged to some of the ports of the Mediterranean. The demand for coke is increased, both for home use and export, and prices are firmer generally. Gas coke is rather limited in make, as is usual in July; and the quotation is from 30s. to 32s. 6d. per ton f.o.b. in the Tyne, with a heavy freight to be added when for export.

Birkenhead Water Scheme.

Referring in the Birkenhead Town Council to the progress of the water scheme, Alderman Bloor said that last year the Treasury restricted fresh issues of capital by local authorities and others, and limited the expenditure by the Corporation on the Alwen scheme to £200,000 during the year 1915-16. A Special Sub-Committee of the Finance Committee considered the position in which this decision placed the Corporation, and allocated a sum to be expended against each of the contracts. Owing, however, to the scarcity of labour, the sum allocated could not be spent; and at the end of March last a certain amount remained unexpended. In February this year, the Treasury were again approached with a view to sanctioning the raising of further capital to enable the works to be proceeded with during the year; but after full consideration they had only consented to the borrowing of sufficient money to complete the Alwen dam and reservoir and Cross Hill tank works, and certain money for the purpose of temporarily closing-down all other contracts. The Committee were of opinion that the negotiations between the Corporation and the several contractors should be by a Sub-Committee, and unanimously recommended that the matter be left to the Special Sub-Committee of the Finance Committee. The Alwen dam and Cross Hill tank works would be proceeded with, and it was hoped would be completed during the present financial year. The Committee had temporarily terminated the engagement of nine assistant engineers and inspectors; the services of four being still required in connection with the contracts.

New Reservoir for Bideford.—An important step towards the improvement of the water supply of Bideford, which has been a cause of anxiety for many years, was taken last week, when the Town Council adopted a report of the Water Committee recommending the construction of a new reservoir. The site selected is the Upcott Valley, about 1½ miles from the town. It is pointed out by Messrs. Moore, Bateman, and Fox, who reported on the scheme, that, owing to the configuration of the ground, only a short dam will be necessary, and that a reservoir to hold 27 million gallons of water can be constructed. A total supply of at least 330 million gallons per annum may be expected from this source. The water will be pumped to the Corporation service reservoir. The Engineers had no doubt that, if the scheme were adopted, an unfailing and abundant supply of water would be secured for the town. On the basis of such prices as may be anticipated at the termination of the war, the cost is estimated at £13,588.

The "Economy" of One-Burner Gas-Stoves.

Ironmongers, and particularly those who have a workshop, were recommended by the "Ironmonger" last month to watch carefully what is occurring in connection with the extended use of gas for domestic purposes. It is a commonplace, it was remarked, that the business of selling gas-stoves and gas-cookers has been largely captured by the gas companies; but recent official hints that economy in coal consumption should be practised are apparently beginning to bear fruit, and there is a marked increase in the demand for portable gas-cookers, and, to a less extent, for water-heaters fitted for gas—particularly those controlled by thermostats. It is claimed for the portable gas-ovens now upon the market that they save 75 per cent. of gas in cooking; but ironmongers will do well to be careful in accepting responsibility for this claim towards their customers, otherwise what appears to be a really good thing may become discredited. Under demonstration conditions it may be possible to effect such a saving; but to lead the public to expect that their gas bills are going to be reduced by 75 per cent. if they use these ovens is over-stating the facts, because in ordinary domestic usage it is impossible to comply with the essential demonstration conditions. Given suitable apparatus and three or four pots going at one time, considerable economy can undoubtedly be effected, particularly if time is not the chief factor, as is often the case in the preparation of a dinner. But it must not be forgotten that a gas-cooker is chiefly used intermittently for boiling water, cooking eggs, grilling bacon, and other duties which are independent of each other, and in such cases the actual economy arising from the use of these one-burner stoves is considerably diminished.

Bentham Gas Company.—The annual report of the Bentham (Yorks.) Gas Company showed that, notwithstanding the further increased cost of coal, it was possible to recommend a dividend of 5 per cent., free of income-tax, which was considered particularly satisfactory, in view of the fact that the price of gas had not been increased.

Economy at Liverpool.—In spite of a unanimous decision of the Water Committee that the inspection of the Vyrnwy water-works was a duty that should be performed, the Liverpool City Council have resolved that for this year at any rate economy shall be practised by cancelling the annual visit of the members of the Committee to the works. It was urged that, as the cost of the inspection was about £200, the money should be saved on the present occasion.

"Assistant Engineer" at 14.—The St. Agnes Parochial Council reported to the Truro Rural District Council last Wednesday that they had appointed J. H. Stephens, a boy of 14, as Temporary Assistant Engineer at the water-works, at a salary of 12s. per week. A letter was read from Mr. G. Roberts, the Engineer, stating that he should not be responsible for the boy when left in charge of the machinery at the pumping-station. The Council decided to refer the matter back to the Parochial Council for further consideration.

Heat-Resisting Glassware

of BRITISH MANUFACTURE.

¶ The Charnley Manufacturing Co., Ltd., are prepared to supply from stock many standard sizes of Heat-Resisting Glass Globes equal in every respect to the finest foreign manufactures.

¶ Buyers interested will be well advised to order samples without delay.

The CHARNLEY MANUFACTURING CO., LTD., GLASS DEPARTMENT,
WHITEFIELD, MANCHESTER.

Morley Gas Undertaking.

The annual statement of the Morley Corporation Gas Engineer (Mr. H. J. Hemingway), presented last week, shows that a loss of £1274 on the previous year had been transformed into a profit last year of £1181, a result which, in view of increased working costs and special war allowances, and also the low price of tar, must be regarded as very satisfactory. The total receipts were £22,289, as compared with £20,505, and the expenditure £13,401, against £14,549. The gross profit was £8888, as compared with £6045; and the net profit, after providing for interest and sinking fund, was £1181. It had been decided to charge £5000 towards the cost of a new retort plant to revenue account; and on March 31 last there was a debit balance of £3304 remaining from this cause. The sale of gas during the year totalled 124,884,400 cubic feet, an increase of 6,412,200 feet on the previous year. For lighting through ordinary meters, the sale increased by 1,965,200 cubic feet, and that of gas for heating and motive power by 5,418,000 feet. The sale of gas by prepayment meter had gone up by 3,150,000 feet. The lighting restrictions reduced the quantity sold for public lighting by 4,121,000 feet. The coal carbonized during the year had amounted to 11,370 tons, a decrease of 2266 tons. The make of gas was 142,358,000 cubic feet, or 12,520 feet per ton of coal carbonized. A heavy increase in the coal bill must be expected in the coming year, as last year, though contracts made in August, 1915, agreed upon an advance of 5s. per ton, there were arrears of deliveries at old prices to come in; and the actual increase has worked out at only 1s. 3d. per ton. A further increase of 1s. is to be put on the current year's contracts. The charge for purifying was only £20, owing to favourable terms secured for the sale of spent oxide. The price of gas has not yet been increased; but the matter will shortly have to come under consideration.

Wages at Leeds.—When the minutes of the General Purposes Committee came up for approval at last Wednesday's meeting of the Leeds City Council, Alderman Wilson agreed to take back a resolution to the effect that the Committee could not see their way to raise the wages of men in the gas, electricity, and cleansing departments; and he gave a guarantee that though Corporation employees who could have been classed as shirkers would receive no half-pay on being called up, all others—such as men who had been previously rejected or had been held back in the interests of the city—coming under the Military Service Act would be put on just the same basis as the first volunteers.

STOCK MARKET REPORT.

Business on the Stock Exchange last week was quite bright and pleasurable. It was the first week of free markets, unfettered with artificial and unsubstantial minimum prices. There was considerable activity as a rule, though towards the close a little slackening was apparent. But the tone was invariably cheerful throughout; and in some lines the prices made improvements on a large scale. The prime factor was, of course, the official intelligence from all the seats of war, East and West—clearly indicative of decisive operations, and not merely sporadic successes.

In Government issues, both the War Loan and Consols started with a biggish rise, and continued very firm. Home Rails were just as strong as they had been the previous week, and the only thing that hindered higher advances was a scarcity of stock to operate in. The Foreign Market was again one of the most conspicuous. The French Loan rose by strides, and touched 89½ on Thursday. Next day the usual profit-snatching set it back a bit; but it was recovering on Saturday. Russians were in great demand, and Japanese, too, while Brazilians were bought. Americans were fair, though rather jagged at times; and the largely increased takings of Canadian Pacific attracted notice. Argentines and South African were better. In the Miscellaneous Market, rubber had a dull time, but shipping and oil concerns were in good form. The half-yearly announcements of the joint-stock banks were regarded favourably.

Business in the Gas Market was certainly quieter, but the tendency was all in favour of higher prices. This feature was especially noticeable in the more important undertakings. Gas Light ordinary continued its steady advance, and gained another point. South Metropolitan also improved; while Imperial Continental rose by quick steps from 85 to 101 (about a couple of months ago the price was 60 or under). Malta and Mediterranean will pay a final dividend of 4s., making 6 per cent. for this year—the same as last.

Bargains done for cash during the week were as follows: On Monday, European 12⅜, Gas Light ordinary 79¼, 79½, 79¾, Imperial Continental 85⅜, 86, 87, ditto debenture 66, Primitiva preference 62s. 6d., 65s., South Metropolitan 82½. On Tuesday, European 13, Gas Light ordinary 80, 80¼, ditto 10 per cent. Bonds 192, 192½, Primitiva preference 64s. 6d., South Metropolitan 83. On Wednesday, Brentford "A" 85, Continental Union preference 54½, Gas Light ordinary 79⅜, 80¼, 80½, Imperial Continental 90, 90⅜, 91½, 92, 92¼, 93, 93½, Primitiva preference 65s. 7½d., ditto debenture (1911) 62, South Metropolitan 82¼, 83. Tottenham "B" 92, 92½. On Thursday, Gas Light ordinary 80⅜, 80½, ditto preference 75⅝, 76, Imperial Continental 93½, ditto debenture 66, Primitiva 36s. 3d., ditto preference 66s. 3d. ditto debenture (1911) 62½, South Metropolitan 82½, 82½, 83, ditto debenture 60. On Friday, Brentford "A" 86, Imperial Continental 97, 97⅜, 97½, 99, 100, Primitiva 40s., South Metropolitan 83⅜, South Suburban 81¼. On Saturday, Imperial Continental 98, 100, 101, Primitiva 40s., South Suburban 82, 82½.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When last Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 80, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5½	Alliance & Dublin Ord.	59—64	8 18 2	..
374,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 8	..
280,000	5	April 29	7½	3/-	Bombay, Ltd.	5½—5⅝	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bourne- 10 p.c.	29—30	5 6 8	..
383,110	10	,,	7	7/-	mouth Gas B 7 p.c.	15—15½	4 10 4	..
115,000	10	,,	6	6/-	and Water Pref. 6 p.c.	13½—14	4 5 9	..
159,740	—	—	—	4	4 p.c. Deb.	..	—	..
992,045	Stk.	Feb. 26	†14	66/-	Brentford A Consold.	261—266	5 5 8	65—66
734,920	,,	,,	†11	55/-	Do. B New	204—209	5 5 8	..
55,000	,,	,,	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
231,400	,,	June 11	4	4	Do. 4 p.c. Deb.	91—98	4 6 0	..
217,880	Stk.	Feb. 26	11	10½	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	,,	,,	8	7½	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
945,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1¼—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	..
560,000	,,	,,	5½	46/8	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	,,	June 11	8	8	Do. 3 p.c. Deb. Stk.	69½—71½	4 8 11	..
800 000	Stk.	,,	4	—	Continental Union, Ltd.	76—79	5 1 8	..
200 000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	5 18 8	54½
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	5½	Derby Con. Stk.	193—195	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	19½—13
16,327,185	Stk.	Feb. 10	4/17/4	42/-	Gas 4 p.c. Ord.	98—102	4 16 6	70½—80½
2,600,000	,,	,,	3½	3½	Light 3½ p.c. max.	76—79	4 8 7	..
4,062,235	,,	,,	4	4	and 4 p.c. Con. Pref.	96—99	4 0 10	75⅝—76
4,674,850	,,	June 11	3	3	Coke 3 p.c. Con. Deb.	72½—74½	4 0 6	..
180,000	,,	,,	10	10	10 p.c. Bonds	..	—	192—192½
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7½	7⅝	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅜	5¾	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	85¾—101
1,385,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	66
235,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 6	..
2,498,905	Stk.	Feb. 26	10	5	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
					B	146—148	4 14 7	..
806,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4¼—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 18 4	..
1,876,892	Stk.	July 29	4½	4½	Newc'tle & G'tesh'd Con.	93½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	83—88	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8/8	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅝	6 9 0	..
60,000	50	Feb. 26	13	65/-	Porisea, Island B	128—131	4 19 8	..
100,000	50	,,	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	,,	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 18 4	36/3—40/-
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4½—5	5 0 0	62/6—66/8
621,600	100	June 2	4	4	,, 4 p.c. Deb.	91—98	4 6 9	..
—	—	—	—	4	,, ,, 1911	..	—	62—62½
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	233—234	4 9 8	..
209,984	,,	,,	10	10	Do. B	232—234	4 9 8	..
533,500	,,	,,	10	10	Do. C	230—232	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	82½—83⅜
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	60
224,820	Stk.	Feb. 26	8½	8	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 8 5	81½—82½
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	110—112	4 9 8	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
187,558	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
647,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham A 5 p.c.	135—138	5 8 8	..
782,275	,,	,,	6	6	District B 3½ p.c.	115—117	5 2 7	92—92½
181,255	,,	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,880	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 8	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,686	,,	,,	6⅞	63/9	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/8	55/1½	,, C 3½ p.c.	110—115	5 2 0	..
852,000	,,	,,	6½	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6⅜	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

Croydon Co-Partnership Report.

In their report for the twelve months to March 31 last, the Co-Partnership Committee of the Croydon Gas Company state that the bonus is at the rate of 2¼ per cent. for the year, the increase in the price of gas involving the reduction of bonus to this rate. The difficulties which confront the Company as compared with a year ago are accentuated rather than lessened. The co-partners will, the Committee feel assured, realize that under these circumstances the system is undergoing a trial, successful emergence from which will more than ever prove its advantages to all concerned. The Directors have decided that the interest credited on amounts held by the Trustees for co-partners shall be at the rate of 5 per cent. instead of the 4 per cent. provided by the rules, and that such increase shall take effect as from April 1, 1915. Up to March 31, from the inception of the scheme, 946 co-partnership agreements have been entered into, and 326 have terminated, leaving 620 agreements in force. Of these 620 co-partners, 172 are now serving in the forces; but the Directors have decided the bonus shall continue to be credited to the accounts as if they were still working for the Company. They are also relieved during their period of war service from payment of the subscriptions to which they would be ordinarily liable to the superannuation fund or the workmen's sick and burial fund, though their membership of these, with the benefits accruing therefrom, is unaffected. During the year, £1876 has been invested by co-partners through the scheme in stock of the Company, making a total to date of £12,458. The number of co-partners who are also stockholders is now 441. In addition there was at March 31 held by Trustees for co-partners £6300 in stock—making the total holdings acquired by co-partners through the scheme £18,758. The savings for the 7¼ years the scheme has been in operation amount to 43 per cent. of the total credited as bonus; and (apart from withdrawals arising from co-partners leaving the Company's service) only £5690 has been withdrawn out of a total of £13,914 available for withdrawal. The Committee say they "desire to record their deep regret at the loss sustained by the Company—and the co-partners—through the death, on May 17, of Sir Corbet Woodall, who always took the liveliest interest in all matters concerning the welfare of the Company's employees, and to whom they all owe a great debt of gratitude for his influence in the establishment of a co-partnership scheme."

Sale of Blyth Gas Stock.—The Directors of the Blyth Gas Company have just concluded the sale by tender of £25,000 new ordinary stock; the whole of the amount being subscribed, at prices ranging from £110 to £105 per cent. The latter figure was the reserve price placed upon the stock, on which a dividend of 6½ per cent. is paid at the present price of gas.

Female Labour at Birmingham Gas-Works.

One of the gas undertakings in the Midlands to adopt female labour is that of the Birmingham Corporation; and some very good photographs of women at work at Windsor Street and Swan Village appear in the current issue of the "Gas Department Magazine." At Swan Village, the results of the experiment of employing women for the hand-riddling of unscreened breeze have proved eminently satisfactory, from the points of view of management, time-keeping, efficiency, and, indeed, in every other way. At Windsor Street, too, women have been quite a success at coke screening and loading, and are carrying out their work in a conscientious manner; and though requiring a larger number of women than formerly of men, the work is being performed as well as ever. Coke is fed into the screening plant direct from the retort-house, as made, and in passing over the screens is sized—the sized material running in a practically constant stream from shoots below. Bags are hung by the women over these shoots, removed as filled, and then stacked or loaded into carts, as the case may be.

Dawlish Lighting Contracts.—The Dawlish Urban District Council have received an offer from the Gas Company to allow one-half of the contract sum charged per lamp for each unlit lamp to the end of September, and to continue the allowance on the same basis for lamps unlit under the Defence of the Realm Act. The contract price for lanterns and controllers must be paid in full. The Council have accepted the terms.

Wages at Bradford.—The Bradford Gas Committee have advanced the wages of labourers in the gas and chemical works departments from 7d. to 7½d. per hour. The rate of pay of bricklayers, masons, sheet-metal workers, and painters in the department has been increased in accordance with the recently advanced standard; and the wages of mechanics, blacksmiths, strikers, and locomotive drivers have been advanced 1s. per week on time rates and 2½ per cent. on piecework, in accordance with the finding of the Committee on Production.

A private company has been formed, styled Stevenson, Herbert, and James, Limited, with a capital of £10,000, in 3000 cumulative preference shares of £1 each and 7000 ordinary shares of £1 each. The firm are dealers in gas-lighting appliances, stoves, engines, lamps, burners, mantles, globes, and appliances for light, heat, or power.

Minutes submitted by the Gas Committee at the last meeting of the Batley Town Council indicated that the Town Clerk had lately been requested to apply to the Treasury for consent to the raising of a loan for the provision of new carbonizing plant. It was also recorded that a report had been submitted as to the condition of the gas-works.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ENGINE FITTER. Leek Urban District Council.
FOREMAN (METER FACTORY). No. 6194.

Meter Wanted to Manufacture. No. 6193.

Meetings.

COLNE VALLEY WATER COMPANY. Offices, New Bushey. Aug. 1. Three o'clock.
COMMERCIAL GAS COMPANY. Cannon Street Hotel. Aug. 17. Twelve o'clock.
TOTTENHAM DISTRICT LIGHT, HEAT, AND POWER COMPANY. Works. Aug. 5. Three o'clock.

General Stores, &c.
SALFORD GAS DEPARTMENT.

Tar.
STRATFORD-ON-AVON GAS-WORKS.

Washer and Condensing Plant.
ASHFORD URBAN DISTRICT COUNCIL. Tenders by July 24.

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COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

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